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Electrical World

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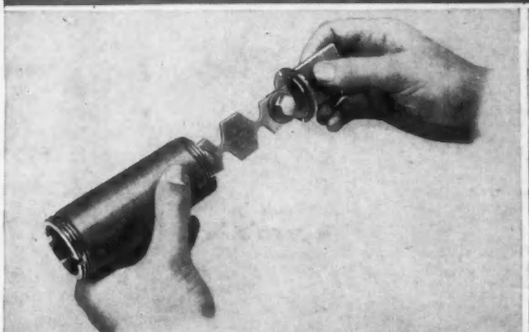
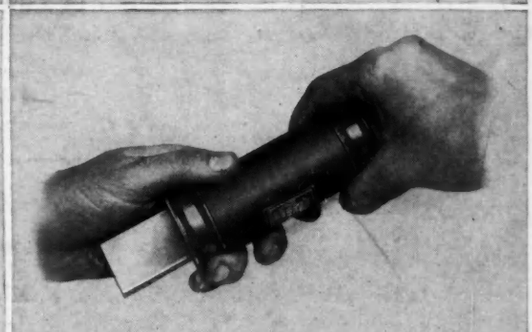
ONLY 6 PARTS 4 OPERATIONS



1. Insert link and blade element in tube

2. Screw on cap

3. Put on split washer



4. Screw on other cap—and it's finished!

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Electrical World

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W. H. ONKEN, JR.
Editor

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Strike of Anthracite Coal Miners Likely

ALTHOUGH there have been efforts made to avoid it, a strike of anthracite coal miners seems likely. Officials in governmental quarters are loath to show their hands until the situation resolves itself into one where political capital can be made from intervention. The recent action also of the Prime Minister of Great Britain in treating with the miners there has emboldened the miners in this country to stick to their demands, so that, all things considered, a strike is almost certain. The continued trouble in the anthracite regions has resulted in higher prices for hard coal, causing the public to use substitutes and to become less tolerant of either miners or operators. Approximately 1,500,000 tons of anthracite is being used by the electric public utilities, this use being confined almost wholly to the Middle Atlantic States. Of late, however, bituminous coal and oil are rapidly displacing anthracite, so that the steam sizes of anthracite have become a drug on the market. Naturally the operators, seeing their market dwindling year after year, are becoming alarmed. They realize that anthracite, however desirable, cannot be sold at too high a price, and while they have settled previous strikes on the basis of the public "holding the bag," they know that further settlements along that line are out of the question. Many persons are learning how to use bituminous coal, coke and oil for domestic purposes, and if their number increases, anthracite miners and operators will find their occupation gone. This may prove the most effective way of curing the incessant ills in the anthracite regions.

Cæsar Speaks for the People

POLITICIANS always feel that the interests of the people have been intrusted to their particular care. In conformity with this belief it is not astonishing to note the latest bid of Governor Pinchot for national comment. Very recently he startled the inhabitants of the Keystone State by removing from office two of the members of the Public Service Commission. "A public service commission ceases to be of value when it fails to protect the interests of the people. You, Commissioners Benn and Shelby, in my opinion have failed in this duty and are hereby removed from office." Words of this general tenor were spoken by the "giant power" Governor when he did his duty. No definite or formal charges were made; no specific reasons were given; no opportunity for a hearing was offered. Pinchot, like Cæsar, willed it so, and that is reason enough.

It seems that the constitution of the state gives the Governor power to remove appointees without cause with the exception of judges and school officials, whereas the act of the Legislature creating the commission stipulates that no appointed commissioner can be removed without a hearing on formal charges. The courts, of course, will have to compose this contradiction.

But, aside and beyond legal questions, the whole cause of regulation is at stake. If public service commissioners must decide rate cases on the basis of the opinion of a governor instead of the evidence presented, chaos will result. Regulation is a legislative function and as such should be free from executive interference. Commissions are creatures of the legislative and not of the executive or judiciary branches of government, and no governor should attempt to usurp the functions of any of the other branches of government merely because their actions do not suit him. Otherwise there will be risk of undermining the foundations of our democratic institutions. The commissioners may be all the Governor imagines they are and more, but that does not justify any governor in believing he is the rate-making authority. The courts have scrupulously observed this distinction and most governors also; but Pinchot is an exception, and as usual the exception proves the rule.

Two Massachusetts Rate Decisions

INCREASES in rates amounting to about 19 per cent for the New England Telephone & Telegraph Company and a reduction of 9.5 per cent in the maximum rate of the Edison Electric Illuminating Company of Boston have just been established in two exhaustive decisions of the Massachusetts commission. In the former case the board was convinced that this action was needed to enable the company to improve its credit and secure ample capital for development. In the latter the decision implies that the company can stand the cut without imperiling a return sufficient to attract new money for expansion. The telephone company obtained within about 4 per cent of its petitioned needs, and the Edison company was put on shorter financial rations, although it is hoped that continued able management will overcome the handicap with the aid of a rapidly increasing demand for service.

One or two points in these decisions deserve comment, apart from the chain of reasoning which led to the final conclusions. The relations between the American Telephone & Telegraph Company, the Western Electric Company, Inc., and the New England company were powerfully attacked in the telephone case, the major assault being aimed at the American company's 4.5 per cent revenue charge for instruments and services rendered its subsidiary. The commission concluded from the evidence in hand that the holding company's services and equipment leased are fairly worth their price, and that this price is but little above cost; also that the New England company, by acquiring supplies from the Western Electric, using its warehouses and its services as purchasing agent, obtains what it requires

cheaper, on the whole, than it could elsewhere. This conclusion should encourage all properly conducted holding company managements to be prepared, as was the Bell system, to render a specific account of their stewardship at all times and so to administer their properties that it will always be easy to demonstrate the economies of group control.

The emphasis of these decisions upon the importance of credit and of maintaining adequate depreciation allowances is gratifying. Somewhat less satisfying appears the board's attempt to compare conditions in the Edison territory with those of the Cambridge and Worcester companies, both of which serve areas absurdly small in contrast with the first. The Boston company was criticised by the commission for the low scale of its large power rates on the ground that these were at times unprofitable and tended to burden other users. Much can be said in defense of competitive power rates, but perhaps the chief lesson of the present case in this respect is the importance of flexibility in power contracts to meet changing conditions.

It was to be expected that the managements of these companies, being human, could hardly pass through two cases of such magnitude without meeting some suggestions from the commission as to budgetary modification. The comments of the board in each decision seem to recognize the principles of public utility credit maintenance, but the commission's interpretation of yield significance in the Edison case appears open to argument. In neither of these cases did the rate base give the commission much trouble, but the time-honored question of what constitutes a reasonable return seems no nearer standardization than ever. Both cases illustrate a painstaking attempt to reach a fair and a constructive conclusion, with the result that one company has obtained a chance to grow stronger and render better service while the other has been put upon its mettle to maintain its prosperity upon a lower unit price.

Who Should Supply Lighting Advice to the Consumer?

AN EASY but inadequate answer to this question is, "All lighting interests." It is not sufficient to state that jobbers, dealers, contractors, central-station companies, etc., should be prepared to supply dependable advice in electric lighting. Usually what is everybody's business is nobody's business. This does not strictly hold in electric lighting because all the interests are to some extent furnishing lighting advice to consumers. But certainly many consumers find it difficult to obtain advice which is really a help to them, and, what is still more important, relatively few consumers know that they need advice. A great deal of fundamental educational activity is necessary first to awaken the consumer's interest. After this has been accomplished the consumer should be rewarded with adequate and dependable advice.

A survey has indicated that less than 10 per cent of the users of light who actually seek advice go to the electric light and power company for it. Considering that about 90 per cent of the cost of lighting is due to the electrical energy consumed, it seems only fair that the central-station company should supply somewhere near this percentage of the advisory service. Furthermore, it seems that the company should be about nine times as interested in having the public seek advice as all the other lighting interests combined. Apparently this is not true at the present time. Relatively few companies have lighting departments, and fewer still are able to take care of 90 per cent of even those who now seek advice.

Is there need for other arguments for including able, alert and adequate lighting departments in the organization of electric service companies? If so, there are many which may be presented—and they have the fascinating accompaniment of dollars directly earned by wide-awake lighting departments.

Transmission Developments and Service Standards

THE value of an interconnected transmission system must be measured in terms of service quality as well as in the dollars-and-cents economies obtained. Any advance in the economic phases of the art should be judged in the light of both these elements of the utility business. Some engineers question the quality of interconnected transmission service in comparison with the service now rendered in metropolitan areas and plead for a better understanding of what may be expected of interconnected plants and extensive high-voltage transmission systems. If enormous investments are now made which result in system operations less satisfactory than anticipated, a setback will undeservedly be given to further developments. It is claimed there are many little-understood operating and engineering problems associated with the interconnected operation of great metropolitan areas.

None of the handicaps to service quality is fundamental, but it is claimed that these systems should not be installed in anticipation of 100 per cent continuity and reliability of service. System stability analyses show some cause for alarm and warrant a complete analysis of a major interconnected system as an asset to permit of developments in the light of knowledge and not by guesswork. Then again there comes into play a problem of communication. If trouble occurs at one point on a system of a complicated character, no major service moves can be made unless the system operator has communication with all points at all times. Only recently a five-minute local outage resulted in a very long system outage because telephone and radio communication systems failed to function during the rain, lightning and thunder occurring during the time of trouble.

The art of relaying must be improved in order for relays to function 100 per cent in times of trouble, and tremendous burdens are placed upon the oil breakers on big power systems. The insulator is yet to be had that will never flash over, and lightning and sleet continue to act occasionally as freakish and uncontrolled destroying angels. Great progress has been made in all these respects, but it must be remembered that the art is comparatively new and that a metropolitan system operates of necessity on a 100 per cent service basis only because it has advanced to its present state of perfection over a long period of time and has a very large part of its capital investment tied into the systems to guarantee the 100 per cent service demanded.

The statements about interconnection are made only to indicate the necessity for neglecting no precautions in the design and installation of interconnected metropolitan systems, and a background balance sheet which shows adequate balance of service against economy should be made for each contemplated development.

Public Relations and Trade Relations

NO MAN who has observed the progress of the public relations work which has been carried on of recent years in the central-station industry has any doubt of its usefulness. It has achieved notable results in interpreting the motives and the methods of the utilities and promoting popular appreciation of the human values of the service which they are rendering. But public relations and commercial policy cannot be separated, and too much of the good influence of these activities is being nullified in many cities by unhappy conditions in the local electrical family.

Public relations depend on public sentiment. Public sentiment grows out of what the people of a community individually think, and men and women form their opinions from what they observe and what they hear. What folly it is then for any central-station company to expect to win popular confidence and general acclaim when there is open dissension between the contractor-dealers and the company and electrical men are constantly criticising and condemning the utility as selfish and unfair! Their word is taken as at least knowledgeable, and the good effect of many brave words and much painstaking service is undone.

It would seem, therefore, that one of the first considerations in the promotion of public relations should be to make sure that all is well at home. Many companies that are thoroughly "sold" on the importance of good public relations are still indifferent to the hurtful effects that come of bad local trade relations. But sooner or later this issue must be met and the house must be put in order.

Advertising and Engineering

MOST of the handicaps engineers experience in the development of their spheres of action are due to lack of understanding by the public and their associates. The fact is often forgotten that the word "engineer" to the public calls to mind a man who operates a railroad locomotive or a surveyor's transit. A specialist engineer in one phase of the art when talking to a specialist in another phase of the art about his specialty forgets that he may be making himself about as intelligible as would an Eskimo. Science and its applications are a hazy and unknown realm to that general public which has been roused so recently by discussions of evolution and religion.

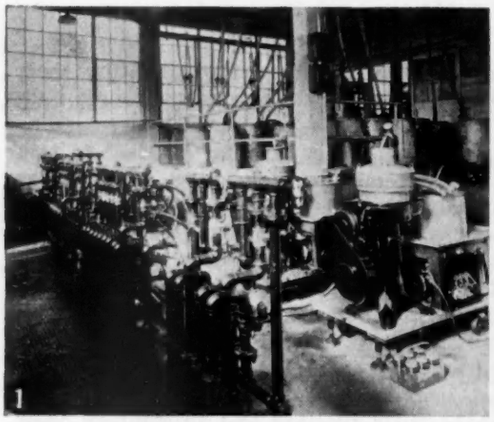
Without mutual and public understanding there cannot be real appreciation of engineers and engineering. The obligation to bring about this understanding rests upon the engineers themselves. Publicity and advertising are necessary studies for the successful development of the engineering art, and engineers can learn much from the theories and practices of the great advertising fraternity. Advertising men are specialists in knowledge and in human nature and know far more of engineers and engineering than engineers know of them and their work. The advertising men and the publicity men have learned the art of adapting their knowledge to their environment through adequate publicity. They tell a story the people can understand.

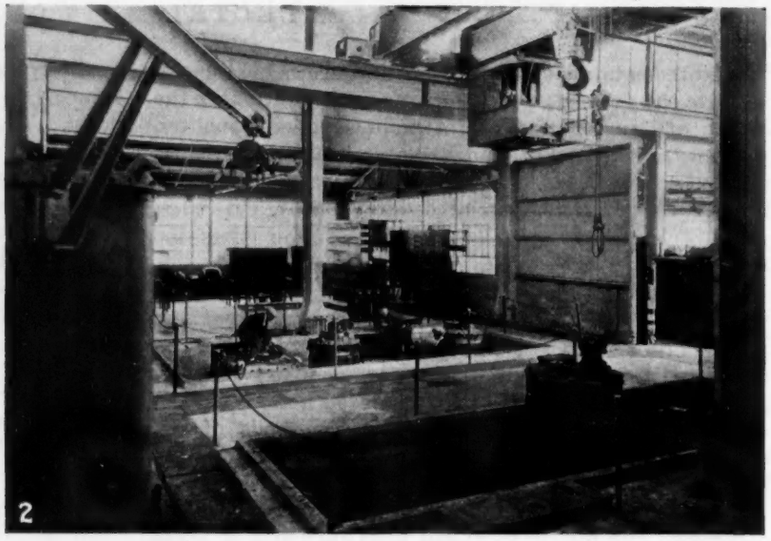
When a specialist engineer gets on his feet to talk about stability of systems, dielectric losses, power factor or other technical topics there usually ensues a flood of elliptical functions, so to speak, instead of logical and understandable expositions of the topics that will convince hearers of the validity of the reasoning in support of a plan of action or analysis. The public, executives, legislators and brother engineers would appreciate a little more advertising along with the technique, and engineers can introduce this element in its larger sense to enhance their position and to improve their status in the world of everyday affairs.

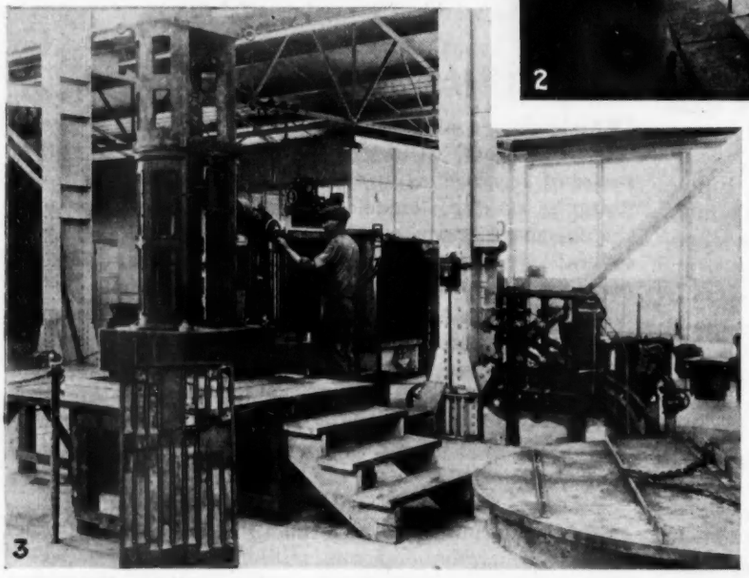
A High-Sensitivity Oscillograph

THERE are at present available a number of very satisfactory oscillographs permitting study of a range of frequencies up to, say, 5,000 cycles. Such, for example, are the Blondel and Duddell bifilar types and the thermo instrument by Irwin. Moreover, there are several types using as movable element a beam of electrons which follow extremely rapid variations of the field, say up to several millions of cycles per second. In this class are the instruments of Dufour, the Braun tube and the recent improvement in the latter by the Western Electric Company. Thus investigators are fairly well equipped from the point of view of frequency alone for almost any range, if they have unlimited current values.

Occasion frequently arises, however, in which it is desired to study the variation of currents of feeble value, say currents of one milliampere or less. The Einthoven galvanometer will read currents of the order of a micro-ampere, but it is an extremely delicate instrument and will not serve as an oscillograph for frequencies beyond about 100 cycles. In a recent number of the *Revue Générale de l'Electricité* R. Dubois describes a new form of oscillograph which is especially adapted for use in the plate and bridge circuits of vacuum tubes, which therefore is sensitive within the range below one milliampere, and which is suitable for frequencies up to 3,000 cycles. In principle a thin, flat strip of silicon-steel alloy is placed in an air gap with its surface perpendicular to the field, owing to a permanent magnet. The strip is pivoted from above at its center, and light springs at either end hold it in position. One of these springs is geared to a concave mirror. Sunk into the poles of the permanent magnet is the coil which carries the current whose variation is to be indicated. The silicon alloy strip is on the axis of this coil. The current in the coil therefore causes the strip to rock back and forth on its pivot, communicating this motion to the mirror. The use of the silicon alloy suppresses the distortion due to Foucalt currents and to hysteresis. The advantages claimed for the instrument are rugged construction, portability, the fact that no field excitation is necessary and a sensitivity fifty times that of other portable types. Interesting examples are given of its application to the recording of noises, both aërial and submarine, the registration of wireless signals and the measurement of small intervals of time. It appears, however, that probably its greatest value will be found in research centering around the performance of vacuum tubes.







New Alhambra Laboratory of the Southern California Edison Company Is Fitted for All Kinds of Tests

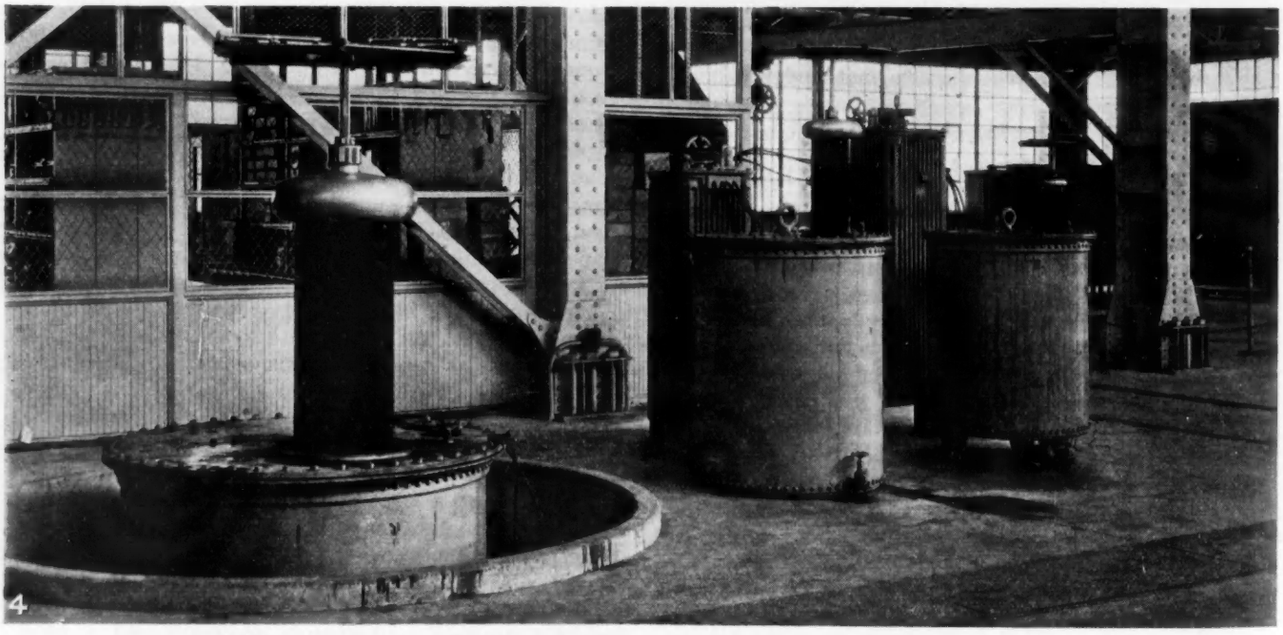


Fig. 1—All oil used is tested and purified before it is shipped from general stores.

Fig. 2—Transformer pits permit tests to be made safely on all system transformers and on high-tension insulators.

Fig. 3—A Riehle testing machine is used to test all construction material.

Fig. 4—The general stores section is shown in the background. In the foreground is the high-tension transformer equipment.

Utility Uses Testing Laboratory

Alhambra Plant of the Southern California Edison Company Has an Apparatus Test Division in Which Equipment Has Been Provided for Testing All Sizes of Transformers, Compensators, Motors, Oil Switches, Insulators, Etc.

By W. R. FRAMPTON

Superintendent Test and Meter Department
Southern California Edison Company, Los Angeles, Cal.

WITH the numerous tests that are called for and requests for special tests on a large central station property, it is necessary that the apparatus test department be equipped with testing equipment and power supply that will meet any testing condition that may arise. In the new Alhambra shops of the Southern California Edison Company ample provision has been made for the testing of all station and distribution transformers, compensators, motors, oil circuit breakers, insulators, etc. All such apparatus is tested before being placed in service, no matter whether it is coming from the manufacturer, the line or the repair shop.

Setting apparatus up for test and making the necessary connection must be done with a minimum of time and expense, at the same time observing every precaution of safety to the workmen and apparatus. It is important that the switchboards and feeders be designed in such a manner that several tests may be made at the same time without interference. The inside apparatus department in the new shops has a floor space of 12,698 sq.ft., a floor plan being shown in Fig. 1 and a general view of the department in Fig. 2.

The power supply is from a substation in the rear of the department. (Fig. 3.) It is fed by two 15-kv., fifty-cycle feeders from different substations, one 15-kv. tap going directly to the test floor through disconnects and oil switch. The station has a bank of transformers of 3,000 kva. capacity connected 16,500 volts delta to 2,300 volts delta. Two 2,300-volt feeders from the transformer bus are carried to a bus divided into two sections, each section being equipped with a 250-amp. induction regulator. These are known as station E and W buses. All buses and lines may be operated in parallel. From station E bus all station light and power are supplied through various circuits. This includes oil shed, cranes, all shop motors and electric ovens, ornamental street lights and general lighting. This bus also feeds another bus called the inside E bus, which is located in the apparatus department and is equipped with two circuits, each having disconnects.

One of these circuits feeds a 300-kva., 2,300-volt delta to 110-220-volt delta bank of transformers used to supply the laboratory and meter-testing departments directly to their plug boards. The other circuit feeds an 80-hp., fifty-cycle synchronous motor coupled to a 75-kw., 2,300-volt, three-phase, sixty-cycle synchronous generator by means of a link belt silent chain. The exciter on the synchronous motor is mounted on the shaft, while the exciter for the 60-cycle generator is driven by a belt from the generator shaft. This main 60-cycle generator may also be excited from the d.c. panel.

From the station W bus there is one circuit taken to the insulator test station, located in the general store section of the laboratory. It is used single phase stepped down from 2,300 volts to 220 volts through a 25-kva. transformer. A single-phase induction regulator is excited on the low-tension coil having the tie disconnected. This will give a regulation of zero to 2,200 volts on the high-tension winding of the regulator. The high-tension leads from the regulator are connected to the 2,200-volt windings in parallel on 2 to 10-kva., 40,000/2,000-volt transformers. With the high sides in series, any voltage may be obtained from zero to 80,000 for insulator testing. The board is equipped with an oil switch and voltmeter.

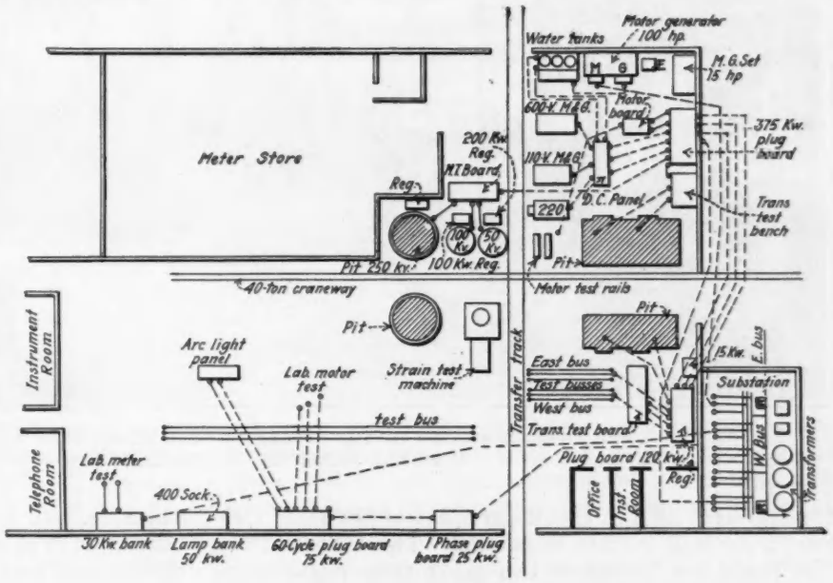


FIG. 1—FLOOR PLAN OF APPARATUS TEST DEPARTMENT

Another circuit taken from the station W bus through an oil switch and disconnects terminates at a bus through disconnects in the apparatus department. This is known as the inside W bus and has three feeders. One of these circuits goes to a board known as the single-phase plug board. Its dimensions are 42x48 in. and it is equipped with receptacles for seventy-two plugs. It has an equipment of an oil switch, voltmeter and

ammeter, also 25-kva. transformer, 2,200-volt primary, with 5 per cent and 10 per cent taps to 110/220/330/440 volts. There is a tie between this board and a sixty-cycle board to be explained later. Leads are connected from the single-phase plug board to a test bench equipped with short-circuiting switches and the proper terminal posts for testing single-phase distribution transformers.

The second circuit from the inside W bus feeds a plug board through a 150-amp., 2,300-volt induction regulator, shown in Fig. 5. This board is 8x6.5 ft., equipped with 328 receptacles used for various combinations of voltages and capacities. It has three transformers 10 kva. each and three transformers 30 kva. each, mounted on the back of the board. Each is rated at 2,200/1,100 volts, with 5 per cent and 10 per cent taps to 110/220/330/440 volts. All connections are made by plugging jumpers, and it is readily seen that the voltages that may be obtained are numerous. All taps as described in the 120-kva. plug board. This board is interconnected with all test benches, boards and panels.

The transformer test bench connected to this board is of the latest design, having the new type short-circuiting and oil switches. Leads from this bench are directly connected to the N and S stations of the E transformer pit. This may be seen in illustration 2 on page 304. It may be noted here that there is a direct three-phase tie connecting the two pits that may be used if desired.

SWITCHBOARDS AND PANELS

The sixty-cycle panel used for the control of the frequency changer set is 42x48 in., its leads terminating at the large plug board for distribution. A sixty-cycle generator is driven from a 50-cycle motor connected to the inside E bus and the necessary instruments have been provided. The motor test board is

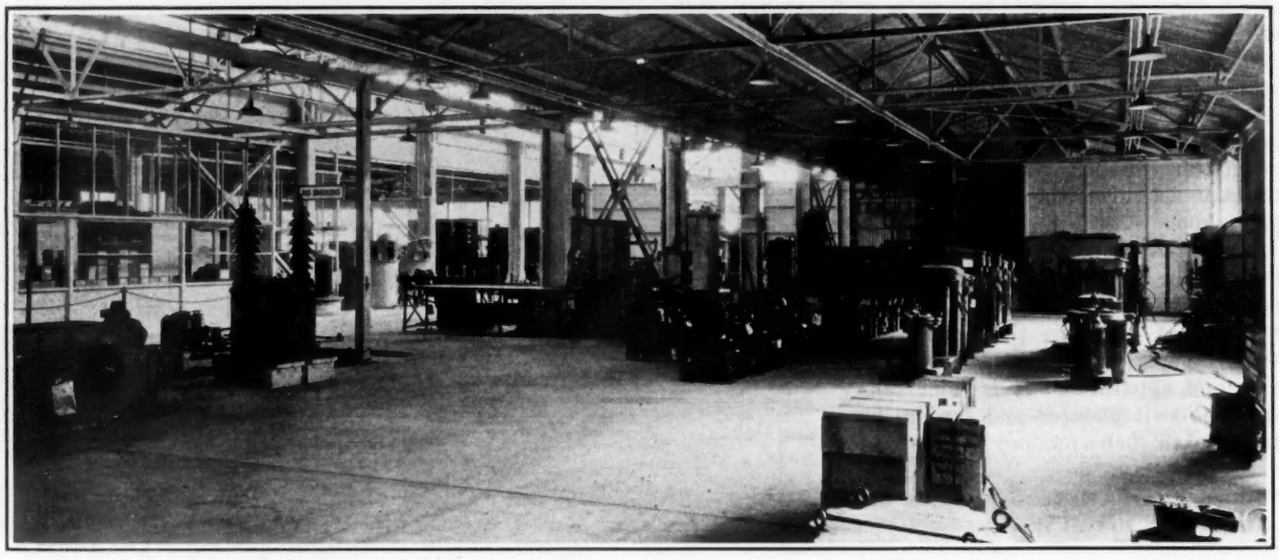


FIG. 2—GENERAL VIEW OF THE APPARATUS TEST DEPARTMENT AT THE ALHAMBRA SHOPS OF THE SOUTHERN CALIFORNIA EDISON COMPANY

transformers used in this department of the same voltage rating will operate in parallel. Two circuits from this board are carried to two upper three-phase buses about 20 ft. long, running horizontal, and are used for drop feeders when testing transformers or special equipment. Two other feeders from this plug board go to the W transformer pit, to be explained later. Two more circuits to the test bench are used for large transformer tests, and there are three circuits interconnecting with a large 375-kva. plug board. Transformer test benches are approximately 15 ft. long, having special equipment, and are so designed that instruments may be easily connected for any test, including heat runs, dry outs, special curves, etc.

CONVENIENT PLUG BOARDS USED

The third circuit from the inside W bus is used as a feeder to what is termed the large plug board, shown in Fig. 5. The board is 8 ft. high and 10.5 ft. long. It has 448 receptacles used for plugging. It is equipped with three ammeters, one voltmeter and an oil switch; it also has mounted on the back of the board three 25-kva. transformers and three 100-kva. transformers. These have the same voltage ratings and 84x42 in. and it is fed directly from the large plug board. It is so connected that two separate three-phase motor tests may be conducted at the same time. One side has a capacity of 300 amp. and the other 100 amp. A special feature of the 300-amp. side is that the current may be read on each phase with the same ammeter by means of interlocking switches. Leads from this board are carried to a terminal board close to the motor test rails. Two sets of standard street car rails are used, one set imbedded in the concrete floor and the other set at right angles and clamped for any commercial motor.

A d.c. panel 42x72 in. is directly connected to the large plug board. This panel is used for d.c. distribution and d.c. motor tests. It consists of three panels. The first has twenty receptacles with the necessary instruments and is fed from a 150-volt d.c. generator driven by a 10-hp. motor. The second panel is identical with the first except that it is fed from a 600-volt d.c. generator driven from a 25-hp. motor and is designed for 600-volt d.c. distribution and tests. The third panel has twelve receptacles and is for 220-volt d.c. tests. It is fed from a three-wire, 110/220 volt d.c. generator rated at 200 amp. Two 50-gal. water barrels are con-

nected to this board that are used for load. Very often this generator is belted to an a.c. motor under test and the water rheostats used for load.

HIGH-TENSION TEST SETS

The equipment used for insulation tests on apparatus consists of three transformers each equipped with individual single-phase induction regulator and oil switch fed from the large plug board shown in Fig. 5. The first is rated at 100 kva., 250-kv., with one side of high-tension winding tied to the case and grounded. The transformer is set in a pit approximately 5 ft. deep. The range of the voltage from this transformer by means of its regulator is 0 to 250 kv. The secondary winding used for excitation is rated 4,800 volts. The primary voltage is measured by a third winding with a voltmeter having a ratio of either 1,000:1 or 500:1.

The second transformer is rated 100 kva., 100 kv. This transformer is set on the floor, having one side of its primary tied to case and grounded. Its secondary also has a rating of 4,800 volts, but its third winding used for voltmeter readings has a ratio of 100:1 and 50:1. Voltages may be obtained from 0 to 100 kv. by the use of its regulator. With the secondaries of the above transformers in parallel and by using the 200-kw. regulator a voltage of 0 to 350,000 volts may be obtained. The voltage readings are correct when added. Care is taken to insulate apparatus under test.

The third transformer is rated 200 kva., 50 kv. This transformer is portable and is designed to test apparatus requiring large capacity due to high charging current. Its primary voltage is 4,800 volts, with a regulator giving zero to 50,000 volts on the primary. One side of the high-tension winding is tied to the case and grounded. The voltmeter winding has a ratio of 100:1 and 50:1. All transformers are equipped with special bushings with reactors and resistances to limit the primary current. Each transformer is also equipped with sphere gaps for accurate voltage measurements. A special feature is a switch and terminal studs mounted on each transformer so that the primary current may be measured. The regulators are hand operated with a 100 per cent boost or buck and are excited from a 2,400-volt circuit.

A sixty-cycle plug board with 165 receptacles is connected with the main plug board with six No. 0 wires.

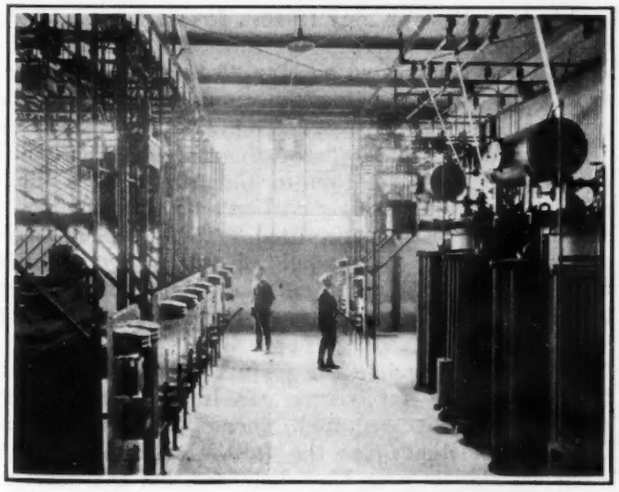


FIG. 3 — SUBSTATION FOR MAIN LIGHT AND POWER SUPPLY TO GENERAL STOREROOM, SHOP AND TEST DEPARTMENTS, ALHAMBRA SHOPS

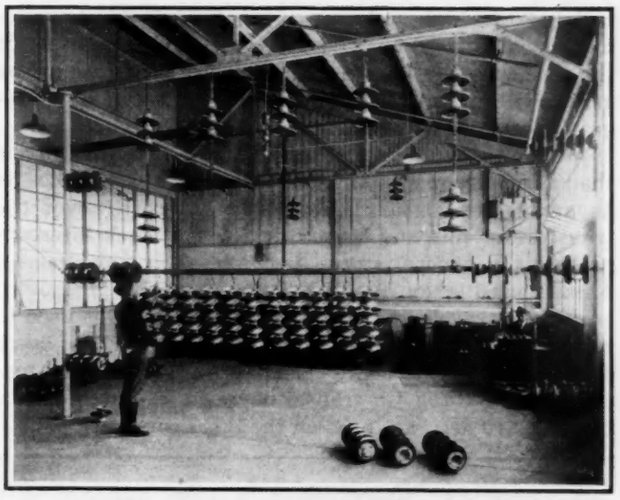


FIG. 4—TESTING HIGH-TENSION INSULATORS

This board is approximately 8x5 ft. and in addition to instruments and switches contains three 25-kw., 2,200 delta to 110/220/330/440-volt transformers. It is normally used to feed sixty cycles to the laboratory and to the meter test plug boards over No. 6 wires to each. There is also a direct tie from this board to a lamp bank consisting of 400 sockets that may be used for any load by means of series and parallel switches. There is an overhead bus 60 ft. long used for connecting temporary leads to apparatus under test. A tie between this board and the single-phase plug board has already been mentioned.

Three leads are carried from the 60-cycle plug board to the street lighting test panel. This panel is 24x30 in. and is equipped with voltmeter and ammeter. It is used for testing all types of street lights, including d.c. and a.c. arcs. Repairs to arc lamps are also made in this department.

TRANSFORMER TESTING PITS

The two transformer pits previously mentioned are 12x26x10.5 ft. (See illustration 2, page 304.) Each is equipped with two steel ladders, two lamps and two terminal boards for connections to apparatus in the pit under test. Two 2½-in. oil lines are connected with the oil house and are used for filling, circulating and draining transformers. One line runs direct to each pit and the other is connected with each pit through a booster pump. A system of valves, taps and hose connections near the pumps permits filling and circulating oil in the transformers. A steel tank 15 ft. deep and 9 ft. in diameter has been placed in the floor with a removable cover handled by a crane and directly connected with the oil system for use in testing transformer cores, bushings or any apparatus requiring an oil-submerged test.

COOLING SYSTEM

A 3-in. water main with valves is connected to each pit and is used for water circulating in temperature runs. Another 3-in. pipe from each pit is used to carry the circulating water to a cooling tower located outside the building. Valves are arranged and a water pump is so connected in the main feeder as to aid circulation. Flow meters are connected to measure gallons of water per minute. The pits are also equipped with an automatic pump used to drain the sump. The cooling tower is made of standard wood construction and is approxi-

mately 30 ft. high with a reservoir 8x10x3 ft. An automatic float valve connected to the city water main keeps the water at the proper level. Valves and pumps are so arranged that this tower may be used for any test requiring a water-circulating cooling system.

A 40-ton crane is installed which travels from the railroad spur over the general storage space into the apparatus test department. It runs directly over the transformer pits and terminates over a track interconnecting the general stores, test and shop departments. This is used when handling large apparatus. A 5-ton crane also travels on the 40-ton craneway and is used in handling lighter equipment, including the oil tank cover and tower sections being taken to a strain-testing machine. Two 2-ton jib cranes, having a radius of 20 ft. through 270 deg., are used on the test floor. One is used

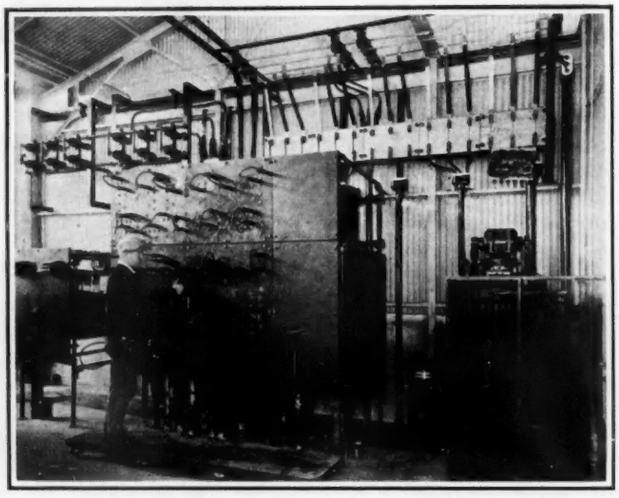


FIG. 5—PLUG TEST BOARD WITH 328 RECEPTACLES USED FOR VARIOUS COMBINATIONS OF VOLTAGES AND CAPACITIES

over the motor rails and swings from the motor test floor to the 40-ton craneway and interconnecting track. The other is used in handling distribution transformers and swings from the main craneway and interconnecting track to the transformer test floor.

All heavy apparatus being transferred between the shop, general store and test departments is moved by means of a Mercury tractor over the interconnecting tracks. Smaller equipment is often moved with this tractor by means of trailers. The batteries used in this tractor are charged by means of a motor-generator set with complete panel installed in this department. Four trucks may be charged at the same time with the present equipment.

OIL TESTS

All oil handled by the general stores division is tested before being shipped. This necessitates a large storage capacity and good equipment for the efficient handling of oil. The oil house has a floor space of approximately 100 x 40 ft., divided into two sections. One section is used entirely for storage of oil drums ready to be shipped upon requisition. The other section is used for testing, filtering and distribution (Fig. 1, page 304). All oil is controlled from five headers and by means of a system of valves, pumps, tanks and hose connections it is transferred and purified with very little difficulty.

Two De Laval purifiers and two 12-in. filter presses are used for the filtering of oil. Also two hot air driers are permanently connected to hoses that are used for drying drums after having been cleaned. The filter press blotters are dried in an electric oven having compartments, each containing 100 blotters. Four 50-gal. measuring tanks equipped with overflows are used in the filling of oil drums. Two 400-gal. tanks are used in the process of purifying the oil.

TESTING MACHINE

A special feature of the apparatus test department is the Riehle testing machine (Fig. 3, page 304). It occupies a floor space of approximately 20 sq.ft. It is equipped with a three-phase, 5-hp. a.c. motor having four speeds forward and four reverse. Three sections in the tower have been added since purchasing, which greatly increases the range for testing materials of different lengths. It has a capacity of 200,000 lb. and is accurate within plus or minus 0.5 per cent. It is used for testing either tensile strength or compression without angular displacement. Samples of each shipment of hardware to be used in construction is given an acceptance test. All dynamometers and turnbuckles used in line construction are tested before being placed in service. Special strain tests are made on suspension type insulators from different manufacturers to determine the grade of porcelain and hardware used. Ropes, cables, chain blocks, bolts and other materials and apparatus requiring special tests are tested upon the request of the construction and engineering departments. Very often electrical potential tests are applied to the materials under test in conjunction with the mechanical strain.

Telephotograph Added to Commercial Communication Facilities

SENDING and receiving apparatus for the transmission of pictures over telephone lines have been installed for regular service between New York, Chicago and San Francisco. This service has been closely and continuously followed by newspapers and press associations, which made extensive use of it during recent tornado and earthquake disasters. Interesting experiments in the transmission of finger prints and quick identification of criminals were recently made by the identification bureau of the New York Police Department before the International Police Conference held in New York on May 12-16. The usefulness of the telephotograph service to the medical profession was strikingly demonstrated on May 28 before fifteen hundred physicians attending the annual meeting of the American Medical Association at Atlantic City. The demonstration took the form of a long-distance clinic during which a physician in Chicago made a diagnosis of charts depicting a patient's heart action, these charts having been transmitted by the telephotograph method. By means of a public address system installed at Atlantic City the entire audience of physicians heard the diagnosis which came from the Chicago physician over the long-distance telephone lines.

The broad principles of picture transmission have been recognized for years. Their production from successful practice required, among other things, perfection of methods for the faithful transmission of electrical signals over long distances and the development of special apparatus and methods which have become a part of the communication art only within the last few years.

Detecting Flaws by Magnetic Analysis*

Disturbing Effects of Stress Must Be Eliminated or Evaluated Before Reliable and Satisfactory Method Is Developed—Description of Investigations Carried On in Bureau of Standards

By R. L. SANFORD
Chief Magnetic Section, Bureau of Standards, Washington, D. C.

NUMEROUS attempts to use the methods of magnetic analysis for the detection of flaws and internal defects in steel have led to results that are practically impossible of satisfactory interpretation. Although it is true that internal defects always give rise to variations in magnetic permeability, there has always been confusion, caused by similar effects that could not be correlated with corresponding defects or flaws. The resulting uncertainty in the interpretation of results places a serious limitation on the practical applicability of the method.

Accumulated evidence indicates that one source of the difficulty is the effect of mechanical stresses within the material. It is known that a relatively moderate stress, externally applied, produces a very large change in magnetic permeability, especially at the lower values of magnetizing force, and it is reasonable to believe that internal stresses resulting from various processes of manufacture would have a correspondingly large effect. The first step, therefore, in the development of a reliable and satisfactory magnetic method for the detection of flaws must be the discovery of a way either to eliminate from the records the disturbing effects of stress or to evaluate them so that they can be properly taken account of. A considerable amount of effort along this line is justified by the great potential value of such a non-destructive testing method from the industrial point of view. It is with this thought in mind that an investigation of the possibilities of magnetic analysis as a non-destructive method for testing wire hoisting rope has been undertaken by the Bureau of Standards. In the course of this investigation a clue to the solution of the difficulty just mentioned has been discovered, which may be of sufficient interest in connection with other developments to warrant description at this time.

The apparatus for magnetic exploration of relatively long specimens of uniform cross-section consists essentially of three parts: a magnetizing coil, a test coil or some combination of test coils, and an indicating or recording device. These are shown diagrammatically in Fig. 1. In operation, either the specimen is passed through the magnetizing and test coils at a uniform rate or it is kept stationary while the coils are moved. The specimen is thus subjected to the influence of a magnetizing force of constant value, which moves along the bar at a uniform rate. If the specimen under test is uniform in magnetic permeability along its length, the test coil is always linked with a magnetic flux of the same value and no current is induced in the test coil circuit. On the other hand, if the permeability is variable along the length of the specimen, the flux linked with the test coil varies and a corresponding current is induced. This induced current can be observed by means of a suitable galvanometer. It is also possible to record the variation in flux by means of a spot of light reflected from the galvanometer mirror upon a moving photographic film or sensitized paper. In the records thus obtained, a specimen magnetically uniform along its length is characterized by a straight line, while variations in magnetic permeability are indicated by departures from a straight line.

Typical records that illustrate the difficulty of their interpretation are shown in Fig. 2. The top record was taken on a sample of stream line wire such as is sometimes used in the construction of airplanes. So far as can be determined from the evidence available, the wire has no defects and is satisfactory as regards its mechanical quality. This wire was taken from a plane that had been in service for a considerable period and had shown no signs of failure. Two other wires from the same source gave practically identical records.

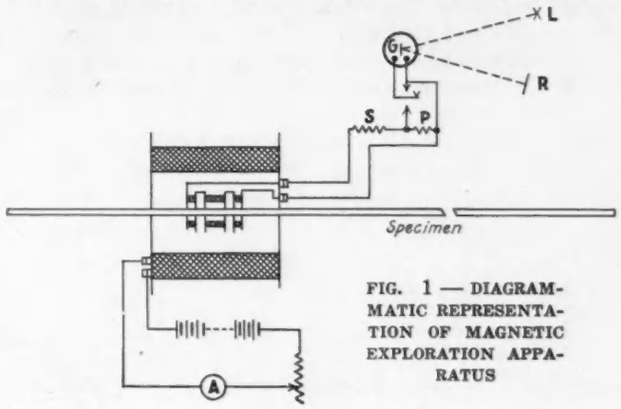


FIG. 1 — DIAGRAMMATIC REPRESENTATION OF MAGNETIC EXPLORATION APPARATUS

A careful study revealed the fact that the curves are periodic and that the length of the period corresponds with the circumference of the 8-in. roll with which they were rolled to the stream line section. In the second curve a wire that originally showed little variation in magnetic permeability along its length was intentionally injured at *A* by bending it to a right angle and straightening again. Note that the resulting change in permeability is of less magnitude than the variations found in the first wire. The third and fourth records are for steel wire such as is used in the manufacture of wire rope. The original magnetic condition of the wire is indicated in the third record. After intentional injuries had been introduced by filing a notch at *B*, bending at *C* and heating with a match at *D*, the record shown in the fourth curve was obtained. The effect of the notch filed at *B* is so small that it would certainly be overlooked in comparison with the irregularities previously existing. These records are typical of the results previously obtained by magnetic exploration and illustrate the practical impossibility of properly interpreting the results of tests on unknown samples.

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The effect of stress on the magnetic properties of steel wire is illustrated in the curves of Fig. 3. An externally applied tension increases the magnetic permeability for magnetizing forces below a certain value, and above this point, known as the "Villari reversal" point, the permeability is reduced. The relative change is much greater at the lower values of magnetizing force. It is within the range of greatest sensitivity to the effect of stress that the majority of the experiments on the detection of flaws have previously been made, and the reason for the ambiguity of the results appears to be fairly obvious. It is possible that this same effect is responsible for the difficulty that has been experienced in the attempt to establish the laws of correlation between the magnetic and mechanical properties of steel.

A number of modifications in the conditions and methods of test have been tried, such as the superposition of direct and alternating magnetic fields, various combinations of test coils and magnetizing solenoids and the like, with no improvement in the results. The difficulty with these variations in the method of test was that any method that suppressed the effect of internal stress at the same time suppressed the effect of the flaws it was desired to detect. The solution to the problem, after all, appears to be a simple one and lies in the proper choice of the value of magnetizing force to be used in making the test. The records shown in Fig. 5 were taken on the same wire as the third and fourth records in Fig. 2. The upper record was made with a magnetizing force of about 20 gilberts per centimeter, while the lower record was made at about 100 gilberts per centimeter. Note that the superficial variations due to internal stress are practically wiped out in the lower record, while the effects of the intentional injuries remain. The effect of the notch at *A* is greater and the effect of the heating at *C* is reversed.

These results can be explained in terms of the curves shown in Fig. 4. In the upper curve, the change in

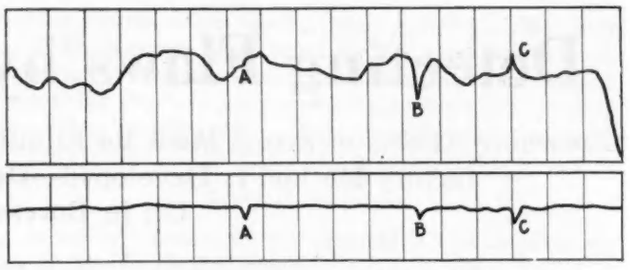


FIG. 5—MAGNETIC EXPLORATION RECORDS SHOWING THE SUPPRESSION OF THE STRESS EFFECT
(*A*) Effect of a notch in the wire
(*B*) Effect of a right angle bend
(*C*) Effect of heat

of the figure the change in induction for given values of magnetizing force is plotted against the applied stress. For values of stress up to about 50,000 lb. per square inch it is seen that the change in induction is practically negligible at a magnetizing force of 75, while at lower values of magnetizing force the effect is considerable.

Also, if large stresses that would seriously impair its mechanical properties should exist within the material, this would be shown with the large value of magnetizing force as a decrease in permeability. Such a condition might exist in a hoisting cable in the case of excessive wear of individual wires resulting in an excessive unit stress. Thus it can be seen that the suppression of the effect of stresses of relatively small magnitude does not necessarily involve the suppression at the same time of the effect of large stresses that should be retained.

It is still desirable to make records using the lower values of magnetizing force, as these give an indication of the degree of homogeneity of the material as regards stress distribution along its length, but these records should be supplemented by others taken at a properly selected higher value of magnetizing force. The proper values to use for a given type of material can best be

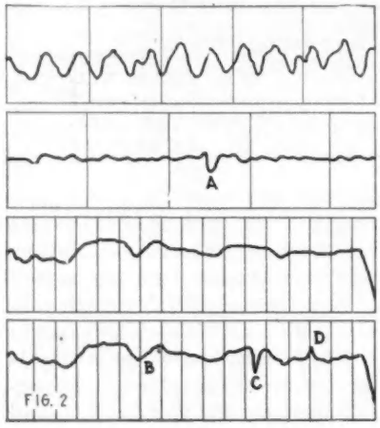


FIG. 2—TYPICAL RECORDS OF MAGNETIC EXPLORATION ON WIRE SAMPLES

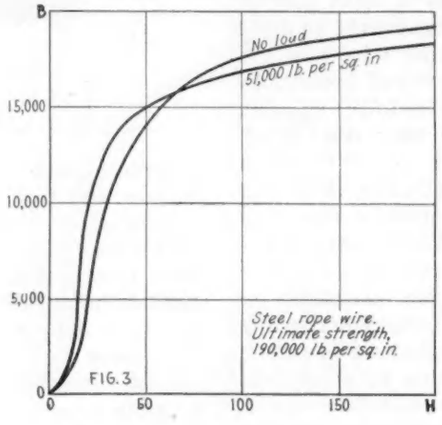


FIG. 3—EFFECT OF MECHANICAL STRESS ON THE MAGNETIC PROPERTIES OF STEEL WIRE

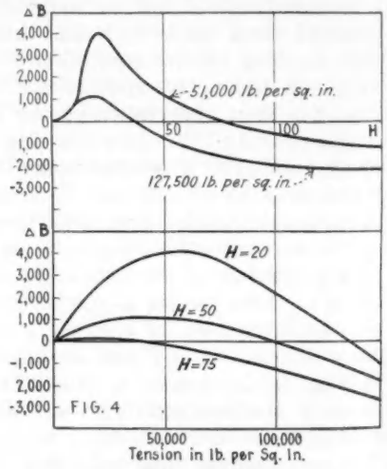


FIG. 4—EFFECT OF MECHANICAL STRESS ON MAGNETIC INDUCTION

magnetic induction ΔB resulting from the application of two different values of tensile stress is plotted against the magnetizing force H. The maximum change in induction occurs at about the same value of magnetizing force and is less for the greater stress. The Villari reversal occurs at a much lower value of magnetizing force for the greater stress, which is somewhat above the elastic limit for the material. In the lower part

determined by experiment. It now appears that, with the aid of data on the effect of specific types of flaws and defects, it may be possible to interpret the results of magnetic explorations in such a way that the results will be of practical value. At any rate it is felt that, with the suppression of the disturbing effects of variable internal stresses, the greatest obstacle in the way of magnetic detection of flaws has been overcome.

Airplane Speeds Up Power Surveys

Contour Maps Made from Aërial Photographs Overcome Many Limitations of Prevailing Methods and Shorten Time of Preparation—Typical Examples of Conowingo Project and Green River Basin

By J. B. BEADLE
Office Engineer Brock & Weymouth, Inc., Engineers, Philadelphia, Pa.

OVERLAPPING VERTICAL PICTURES—FIRST PRODUCT OF AËRIAL SURVEY
Stereoscopic examination and highly refined measurement in special machines serve to correct camera tilt and fix elevations

A PROCESS of using aërial photography for making contour maps has lately been developed to overcome or greatly to lessen many of the limitations that have hampered engineers, promoters and others concerned with large power developments, all of whom have a direct interest in new means for reconnaissance and survey.

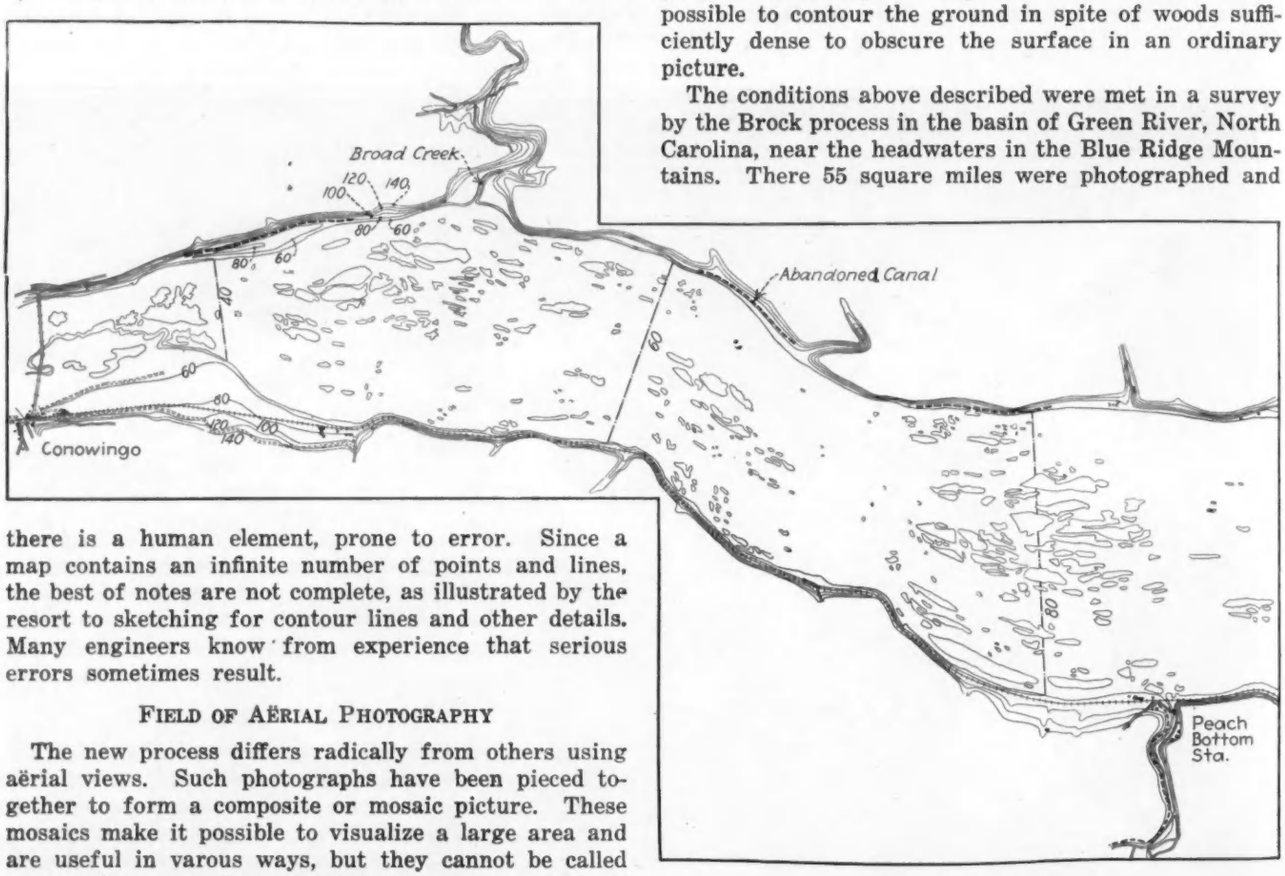
The advantages of the new process are enumerated as follows: The photographic traverse proceeds a mile a minute or faster. It yields a complete record that can be visualized from the start. This does not lean on recollection or judgment of interpretation. It contains no ambiguity. To become an accurate map it must go through certain processes, but machines have been developed to facilitate these and the opportunity for human error is minimized. At each step the record retains its visual quality, comprehensiveness and wealth of detail.

Methods of making these contour maps up to the present time have left much to be desired. The engineer, afoot, on horse, using the automobile wherever conditions permit, may spend weeks or even months seeking reservoir or dam sites, highway routes and locations for canals, pipe-lines and other constructions. Preliminary surveys may add many months and must be supplemented by more complete topographic maps or detailed surveys of chosen sites and routes. A working season is easily consumed before the engineer can intelligently plan the development. If thoroughness of preliminary investigation is sacrificed to speed, expensive mistakes may be made in the adopted program. It is particularly important to have good comprehensive maps where a series of constructions will be made over a period of time, utilizing in successive steps the resources of a stream or drainage basin.

The promoter or investor is naturally impatient at delay. Capital refuses to wait, or accumulates heavy interest charges. Millions are more readily forthcom-

ing for construction than are thousands for surveys. Projects are rejected on the one hand because of the time and expense needed for proper surveys and on the other because without them the most efficient and economical plan of development is not disclosed.

The ways of the transit, level and plane-table are tedious at best, with a slow accumulation of data one point at a time and a separate record for each. The concrete product may be a mass of notes, requiring further laborious processes to make a map. From the first field observation to the last plotting in the office there is a human element, prone to error. Since a map contains an infinite number of points and lines, the best of notes are not complete, as illustrated by the resort to sketching for contour lines and other details. Many engineers know from experience that serious errors sometimes result.



CONOWINGO PROJECT
Part of aërial survey map by the Brock process.

FIELD OF AËRIAL PHOTOGRAPHY

The new process differs radically from others using aërial views. Such photographs have been pieced together to form a composite or mosaic picture. These mosaics make it possible to visualize a large area and are useful in varous ways, but they cannot be called topographic maps, because of their variety or lack of scale. They have no vertical scale, and their horizontal scale varies with the relief. Because pictures are conic projections, each point in relief is thrown out of position according to its elevation and its distance from the axis of the camera. The inevitable banking, pitching and tipping of the airplane precludes holding the camera precisely vertical and the tilt causes further scale variation in the pictures. All these effects, inherent in any air picture, are mechanically measured and corrected in the special method known as the Brock process. By this process contours are added to the photographs and the entire record is reduced to a true-scale map in the shape of a tracing or other form commonly used by engineers.

The advantages of this process are particularly marked in the case of extensive areas difficult of access and survey due to remote location, bold relief or forest cover. Here it offers a combined means of quick reconnaissance, preliminary survey and mapping. In reconnaissance the engineer can get a better view of the country from an airplane and cover more of it in an hour than he can on the ground in a week. His mental picture is much more comprehensive and a reconnaissance record can be made in the form of a mosaic. By proper selection of flying height and camera details he can have a small-scale mosaic, which relatively costs very little. On this can be defined the area to be pictured and mapped at larger scale. The maps are readily made with horizontal scales of an inch equals 200 to 1,000 ft., or for more general purposes with such a scale as 2 in. to the mile. Contours can be mechanically located at intervals of 5, 50 or 100 ft., or other interval consistent with the character and purpose of the map. The optical machines used make it possible to contour the ground in spite of woods sufficiently dense to obscure the surface in an ordinary picture.

The conditions above described were met in a survey by the Brock process in the basin of Green River, North Carolina, near the headwaters in the Blue Ridge Mountains. There 55 square miles were photographed and topography supplied for 40 square miles. The heavy forest cover over most of the area is shown in the illustrations. The map scale was 600 ft. to the inch with contour intervals of 25 and 50 ft. Pictures were taken with the Brock camera mounted in a Fokker plane. The flying was done late in 1923 and the finished map was delivered in sections commencing early in 1924. The work was done for the firm of Mees & Mees, consulting engineers, of Charlotte, in the interest of the Blue Ridge Power Company. C. A. Mees later testified to the value of the aërial survey, stating that the subsequent instrument work on the ground at construction locations showed that the two "checked with remarkable accuracy."

TYPICAL SURVEY CONDITIONS

The Conowingo project on the Susquehanna has been partly surveyed by the Brock process. The vast number of small islands in the stream offers a striking illustration of detail readily obtained by this method. The same information by transit or plane-table would

involve much time and expense. Boyd Ehle, engineer in charge for the Susquehanna Power Company, checked the aëro map against independent surveys and reported excellent results for the former. His experience indicated that the contours of the aëro map gave elevations correct within 2 ft., and other checks have demonstrated that similar accuracy can be assured throughout for the maps made by this process. The limiting error is mainly a matter of mechanical refinement and the outside error of 2 ft. plus or minus is representative of existing machines. New machines are building with a theoretical limit of about 6 in. With these it is expected to locate contour lines with confidence of their accuracy within a foot plus or minus.

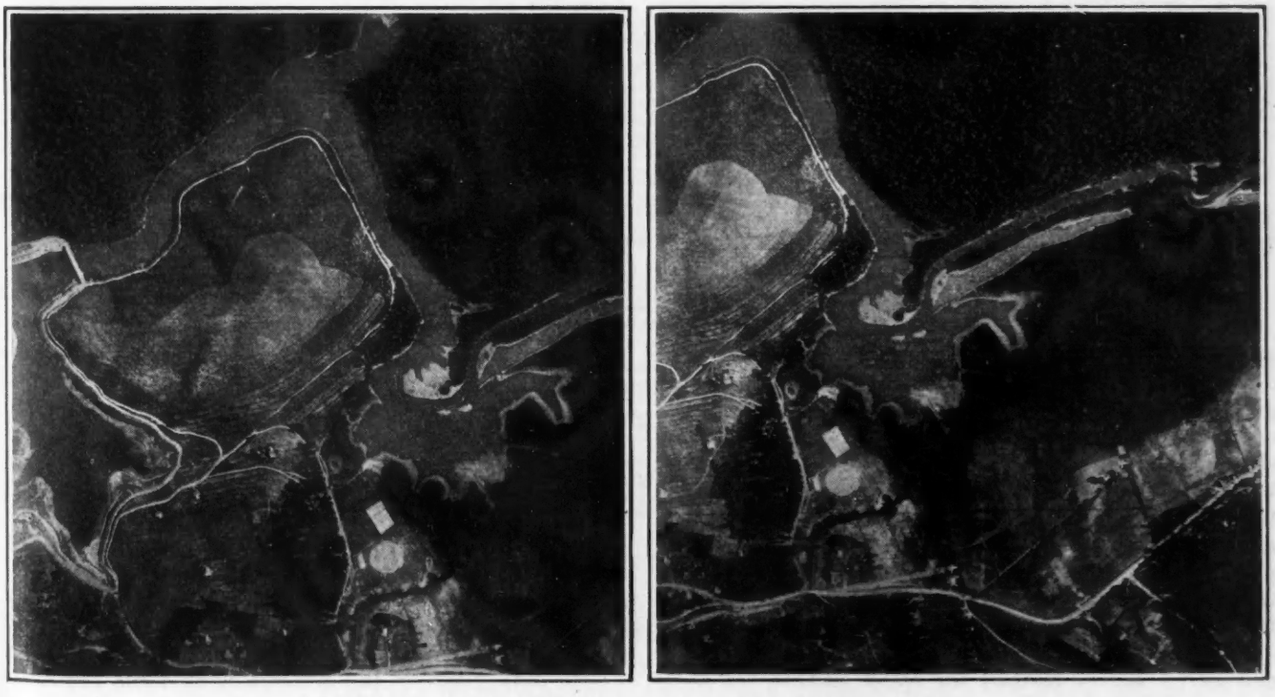
A CONTOURED PLATE

With the Brock stereoscope it is possible to locate the ground contours accurately in spite of foliage that obscures in a single picture

Maps of such high accuracy for extensive areas are ideal for use in planning the best use of stream basins for power, water supply and other purposes, including selection of sites and routes for storage, roads, railroads, transmission lines and other constructions. With such maps the engineer can reach quickly the stage of final location, confining his supplemental ground surveys to localized work on a large scale for determination of quantities in excavation and construction. For project planning, reservoir capacity and numerous other purposes the aëro maps are final.

For the production of such maps the ground work is relatively little and follows conveniently after the flying and photographing. The pictures are examined in a hand stereoscope to select on each a few sharply defined points that can readily be identified in the field. The elevation differences for these are measured by level or stadia. The only other ground measurements required are a few base line distances to supply scale. With such information as a key, the photographic plates are put through office processes that convert the data recorded in perspective in the pictures to the form of a true-scale map.

The office processes are largely carried on under stereoscopic vision, by which two pictures are seen as one and the relief of the ground stands out clearly. At the same time highly refined measurements are made



MOSAIC OF AIR PICTURES—A SUPERIOR RECONNAISSANCE RECORD

An aid in acquiring right-of-way; useful to examine a large area and to choose the portion to be mapped

GREEN RIVER BASIN, NORTH CAROLINA
Piece of topographic map made by Brock process.

of the two representations of the same distance. The differences are due to elevation differences on the ground and to tilting of the camera when the pictures are taken. The first effect is known for the measured elevations. This permits determination of the tilt which is removed by reprojection of the plates. The remaining effect is a clue to the elevation of any point and permits the construction of contour lines on the plates. Then all the data are successively transferred to the final map with conversion to a common scale by further projection and plotting.

It is expected that many more utilities will use the new aërial survey method for many features of their activities, particularly those using large systems in rough country.

Central Stations Eliminating Steam Engine

Turbines Now Seven Times Greater in Rating than Steam Engines—Total Rating of Internal Combustion Engines Decreased—Detail Data from Census

THE table shown on page 315 giving the central-station prime mover installations and miscellaneous circuit data brings out very vividly the gradual elimination of the steam engine by the steam turbine in the generating plants of the country. In 1907 the rating of the steam turbines was less than half the rating of the steam engines. Each subsequent census has shown the steam turbine rating doubling and tripling, while the rating of the steam engines has gradually decreased. According to the latest figures, July 1, 1924, the rating of the steam turbines in the central generating plants is now seven times the rating of the steam engines. Today the steam engine is mostly confined to small and largely obsolete plants. Over one-half of the steam engine rating is located in the North Central States.

The total rating of internal combustion engines seems to have decreased slightly also, especially since 1922. This is probably the result of the extensive interconnection and mergers which have taken place in the last three years, resulting in the elimination of many small plants which were operated by internal combustion engines. There are no data available which will indicate the new installations of Diesel and other oil engines installed since the Census of 1922.

HYDRO PLANTS MAKE GOOD SHOWING

A growth of about 300,000 hp. is indicated for hydro plants from Jan. 1, 1923, to July 1, 1924, a very good showing for the eighteen-month period. The Pacific States lead in the rating of water wheels with 1,608,164 hp., followed by the Middle Atlantic States with 1,141,839 hp.

The data shown for the number of companies reporting a.c. and d.c. motor circuits involves a duplication since many companies reported both a.c. and d.c. service. The West North Central States, which have many small operating companies, reported the largest percentage of companies supplying d.c. service.

The lighting load is overwhelmingly 110 volts, 3,416 companies reporting this voltage on their lighting circuits. A total of 639 companies reported 115 volts on their lighting circuits, and 369 reported 220 volts. A total of thirty-two odd voltages are represented under "other voltages," which were reported by 333 companies, indicating that there is still a large field open for standardization of lighting voltages.

A surprising fact is that there are 1,314 central-station companies in the country which do not have day service. This means that there are still this many companies which do not have an industrial power load and which do not represent a potential field for domestic electric appliances; that is, unless such appliances are used only in the evening. A detailed study of these figures shows that a large percentage of these no-day-service systems are municipally operated, being operated essentially for lighting purposes.

The data given in the accompanying table are compiled from the 1925 issue of the McGraw Central Station Directory.

Rating of Prime Movers in Central Stations and Various Circuit Data

State	Prime Movers				Boilers	Fuel Used, Number of Companies						Motor Circuit (Companies Reporting)		Lighting Circuit Voltage (Companies Reporting)					Day Service (Companies Reporting)		Operate Railways (Companies Reporting)		Furnish Steam (Companies Reporting)		Manufacture (Companies Reporting)	
	Steam Engines, Hp.	Steam Turbines, Kw.	Int. Comb. Engines, Hp.	Water Wheels, Hp.	Hp.	Coal	Oil	Gas	Wood	Gasoline	Kerosene	A.C.	D.C.	110	115	120	220	Other Voltages	Yes	No	Yes	No	Yes	No	Yes	No
United States	1,401,303	7,342,960	291,378	6,147,507	4,274,706	1,311	718	147	142	1	140	4,135	493	3,416	639	160	369	333	4,213	1,314	148	5,379	123	5,404	200	5,327
New England	91,244	774,978	2,780	509,329	285,833	78	16	...	3	...	4	289	13	200	51	7	12	42	283	62	9	336	3	342	...	345
Middle Atlantic	182,112	1,827,4.5	21,42)	1,141,839	970,732	157	16	19	3	1	2	423	36	323	78	13	35	38	418	128	9	537	13	533	...	546
South Atlantic	110.454	490,933	41,039	871,677	423,314	193	64	8	41	...	3	504	18	387	79	16	29	34	453	205	29	629	3	655	40	618
East North Central	556,662	2,426,590	27,106	542,793	1,200,228	358	63	21	14	...	21	870	98	694	147	44	87	61	906	249	39	1,116	40	1,115	7	1,148
West North Central	190,071	655,178	89,516	285,979	432,148	275	185	24	13	...	84	909	214	880	113	34	109	66	1,043	293	20	1,316	52	1,284	25	1,311
East South Central	76,857	326,984	10,736	298,524	442,615	130	48	4	17	...	12	225	36	210	22	4	20	21	220	117	11	326	2	335	24	313
West South Central	126,828	318,971	77,585	9,971	263,890	66	249	59	29	...	8	477	52	421	51	8	43	35	477	147	13	611	2	622	94	530
Mountain	45,826	95,136	14,118	879,231	115,787	53	49	8	7	...	6	263	17	195	59	9	19	19	249	75	6	318	6	318	10	314
Pacific	21,249	426,785	7,078	1,608,164	140,159	1	28	4	15	...	...	175	9	106	39	25	15	17	164	38	12	190	2	200	...	202
New England																										
Maine	10,143	18,840	225	167,693	11,627	4	2	...	2	...	1	58	2	46	5	...	2	6	51	22	2	71	...	73	...	73
New Hampshire	7,465	21,600	1,270	30,852	14,107	9	1	...	1	...	2	40	1	24	8	2	1	6	40	7	1	46	...	47	...	47
Vermont	6,370	10,184	.....	127,987	10,234	11	2	...	...	...	...	45	2	28	9	2	1	8	44	17	2	59	...	61	...	61
Massachusetts	60,941	569,932	580	166,762	170,846	39	8	...	...	...	1	106	5	73	24	3	5	9	106	13	1	118	2	117	...	119
Rhode Island	300	41,564	30	1,210	25,685	1	2	...	...	...	...	11	3	7	2	...	...	5	12	.....	1	11	...	12	...	12
Connecticut	6,025	112,858	675	14,825	53,334	14	1	...	...	...	...	29	...	22	3	...	3	8	30	3	2	31	1	32	...	33
Middle Atlantic																										
New York	90,778	894,898	7,108	963,782	400,351	66	7	5	2	...	2	213	14	163	39	9	15	22	203	69	7	265	2	270	...	272
New Jersey	17,709	23,239	3,357	1,525	139,724	30	5	...	1	1	...	51	2	43	8	...	10	5	54	8	...	62	1	61	...	62
Pennsylvania	73,625	909,268	10,955	176,532	430,657	61	4	14	...	...	...	159	20	117	31	4	10	11	161	51	2	210	10	202	...	212
South Atlantic																										
Delaware	4,735	300	105	.....	15,350	8	1	...	...	...	...	9	1	8	1	...	...	...	8	5	1	12	...	13	...	13
Maryland	2,383	163,890	1,168	26,935	73,281	16	5	...	...	...	...	35	3	25	6	4	4	6	28	14	2	40	...	42	1	41
Dist. of Columbia	5,800	.....	.....	.....	27,050	1	...	...	...	...	...	1	...	.....	...	...	...	1	1	.....	...	1	...	1	...	1
Virginia	11,200	76,555	2,265	47,051	42,088	32	9	...	...	...	...	65	3	48	12	2	6	3	61	25	5	81	1	85	6	80
West Virginia	5,751	98,790	10,535	38,197	103,785	19	...	8	...	...	...	49	2	35	8	...	4	2	52	15	5	62	...	67	4	63
North Carolina	13,216	25,280	1,440	177,723	32,874	34	5	...	2	...	...	100	...	73	16	6	2	6	94	47	5	136	1	140	6	135
South Carolina	9,675	34,900	3,737	208,835	19,940	20	5	...	4	...	...	61	2	43	13	3	1	6	58	18	4	72	...	76	5	71
Georgia	38,386	56,598	14,440	365,936	70,038	56	11	...	26	...	1	119	6	96	19	...	9	10	95	56	5	146	1	150	7	144
Florida	19,308	34,620	7,349	7,000	38,908	7	28	...	9	...	2	65	1	59	4	1	3	...	56	25	2	79	...	81	11	70
East North Central																										
Ohio	99,825	938,527	8,650	14,402	378,500	98	9	15	...	...	1	209	17	152	49	9	18	16	213	57	15	255	7	263	2	268
Indiana	40,803	128,110	3,770	2,041	176,455	77	6	1	1	...	4	148	17	118	20	9	20	6	162	41	4	199	8	195	...	203
Illinois	312,778	1,029,618	5,574	58,0.9	339,966	81	21	2	...	...	7	177	25	166	16	3	13	10	182	63	10	235	12	233	5	240
Michigan	40,717	110,046	5,017	224,362	130,563	57	11	1	5	...	9	147	14	102	31	14	10	14	146	40	3	183	8	178	...	186
Wisconsin	62,539	220,289	4,095	243,979	154,744	45	16	2	8	...	...	189	25	156	31	9	26	15	203	48	7	244	5	246	...	251
West North Central																										
Minnesota	30,717	134,926	5,682	64,164	76,607	50	10	1	8	...	7	154	18	125	17	13	22	14	168	36	2	202	20	184	...	204
Iowa	42,710	91,390	7,954	168,483	83,750	65	9	1	...	...	•3	150	26	138	19	4	19	5	173	41	12	202	13	201	1	213
Missouri	39,085	304,440	13,017	24,196	129,946	59	39	2	5	...	12	142	16	128	18	2	12	9	136	64	3	197	6	194	11	189
North Dakota	16,935	3,250	5,205	.....	15,051	9	6	5	...	...	52	47	68	80	12	4	18	13	90	51	...	141	5	136	...	141
South Dakota	10,052	14,210	12,822	7,065	16,857	24	29	3	...	...	1	72	25	78	12	2	10	4	90	22	...	112	2	110	1	111
Nebraska	19,956	14,194	13,815	15,370	46,158	46	26	...	...	...	5	155	50	168	15	5	17	13	197	42	1	238	5	234	8	231
Kansas	30,616	92,768	31,021	6,701	63,779	22	66	12	...	...	4	189	11	163	20	4	11	8	189	37	2	224	1	225	4	222
East South Central																										
Kentucky	15,074	91,831	2,965	445	49,349	34	13	4	1	...	9	48	22	58	6	...	11	6	58	36	1	93	2	92	8	86
Tennessee	25,790	125,850	2,486	112,184	53,475	43	7	...	2	...	1	70	5	60	6	2	5	6	66	27	3	90	...	93	6	87
Alabama	21,505	78,846	.....	185,895	309,638	17	5	...	9	...	...	46	2	36	7	2	...	2	37	23	1	59	...	60	5	55
Mississippi	14,488	30,457	5,285	.....	30,153	36	23	...	5	...	2	61	7	56	3	...	4	7	59	31	6	84	...	90	5	85
West South Central																										
Arkansas	27,958	41,205	4,353	4,160	39,141	30	21	5	19	...	3	68	9	64	9	...	5	2	70	20	5	85	...	90	9	81
Louisiana	11,205	14,200	14,385	.....	28,197	6	45	3	2	...	...	62	8	52	9	3	7	4	60	18	4	74	...	78	7	71
Oklahoma	39,526	24,982	16,630	1,508	62,246	21	45	29	1	...	...	121	2	105	11	1	5	11	112	37	...	149	...	149	12	137
Texas	48,139	238,584	42,217	4,303	134,306	9	138	22	7	...	5	226	33	200	22	4	26	18	235	72	4	303	2	305	66	241
Mountain																										
Montana	4,838	2,430	1,426	382,986	9,241	11	4	2	1	...	4	40	6	31	9	1	4	2	39	16	2	53	1	54	...	55
Idaho	2,725	.....	20	119,925	2,668	2	1	...	.5	...	...	35	2	23	9	2	3	3	33	14	...	47	...	47	...	47
Wyoming	4,675	2,700	4,362	4,470	15,790	8	9	4	...	...	...	33	2	26	5	1	1	5	29	12	...	41	1	40	1	40
Colorado	16,493	56,146	1,125	73,535	49,148	21	4	...	...	...	2	62	5	47	16	3	4	6	59	13	3	69	2	70	2	70
New Mexico	5,203	5,800	2,930	872	8,353	10	10	...	...	...	...	24	...	17	5	1	...	1	21	5	...	26	...	26	5	21
Arizona	10,614	11,360	2,838	39,876	22,511	.....	19	1	1	...	...	26	...	23	3	...	6	...	25	4	1	28	2	27	1	28
Utah	963	16,550	.....	241,687	8,076	1	...	...	...	...	...	32	2	20	9	1	1	2	33	8	...	41	...	41	1	40
Nevada	315	150	1,447	15,880	.....	.....	2	1	...	...	...	11	...	8	3	...	...	...	10	3	...	13	...	13	...	13
Pacific																										
Washington	7,294	69,263	321	436,269	38,750	1	5	2	5	...	...	68	7	40	15	10	6	6	64	20	8	76	...	84	...	84
Oregon	6,720	74,188	920	107,198	14,734	.....	6	...	10	...	...	50	2	23	12	10	1	5	46	8	2	52	2	52	...	54
California	7,235	283,334	5,837	1,064,697	86,675	.....	17	2	...	...	...	57	...	43	12	5	8	6	54	10	2	62	...	64	...	64

Cost and Prevention of Low Power Factor

Problem Considered from an Industrial Motor User's Viewpoint—Significant Figures that Demand the Bestowal of More Attention Upon This Question—World-Wide Epidemic of Underloaded Motors

By PHILIP CHAPIN JONES
Electrical Engineer Goodyear Tire & Rubber Company, Akron, Ohio

THROUGHOUT the growth of the electrical industry low power factor has been an ever-present problem. Elusive and for the most part unavoidable, it has been always with us to cause a certain economic loss, but one difficult of measurement. From whatever side this problem is approached there are three questions that must be answered:

1. What is the economic loss due to poor power factor?
2. What may be done to prevent poor power factor?
3. With poor power factor existing what may be done to correct it?

It is the writer's purpose now to discuss the first two questions.

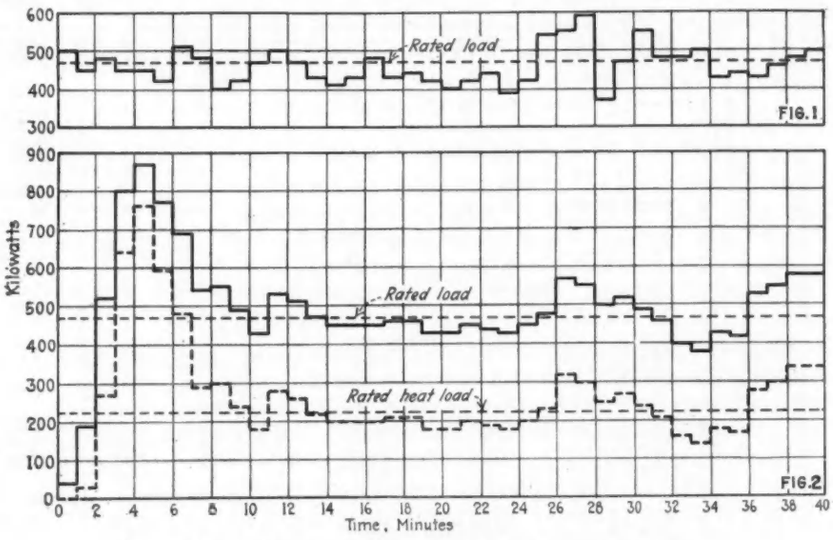
The direct economic loss chargeable to poor power factor is due to the increase in the copper losses—the I^2r losses—caused by current in excess of that necessary to carry the actual kilowatt load. This excess loss is proportional to the reciprocal of the square of the power factor. Thus the copper losses at 60 per cent power factor are $1/(0.6)^2$, or 2.78 times what they would be at unity power factor and 1.78 times what they would be at 80 per cent power factor. The ratio of losses at different power factors to the corresponding losses at unity power factor are indicated in Fig. 3.

In addition to these increased losses there is a secondary and more indirect economic loss occasioned by low power factor. The capacities of electrical machines are largely limited by the temperatures which the machines attain. For this reason generators designed to operate at low power factor are larger and thus more expensive than those designed to operate at unity power factor. Thus if the power factor is low the generators and transformers must be of larger kva. rating and the feeders must have a larger cross-section. This means an increased investment and hence an increase in depreciation charges, in taxes and insurance, and an increase in profits that must be earned or interest that must be paid.

There is still a third loss from low power factor in the additional generator excitation required. However, this loss is relatively small and may in general be neglected.

The cost of electrical equipment usually varies directly with the kilovolt-ampere capacity, so that the fixed charges, depreciation, taxes, insurance and interest or profits will vary approximately inversely with the square of the power factor, as shown by solid line in Fig. 3. Thus if the fixed charges on electrical equipment for carrying unity power factor are $100 a month, they will be $278 a month if equipment has to be put in to carry the same load at 60 per cent factor—an increase of 178 per cent.

Fortunately the fixed charges on the electrical equipment above are not the major part of the total fixed charges. The biggest part of an investment in an ordinary power system is in real estate, buildings and steam or hydraulic equipment. The investment in electrical equipment will probably run from $10 per kva. up. Fifteen dollars may be assumed as an approximate conservative average value of that portion of electrical equipment which varies with the kva. capacity, in order to get an estimate of the magnitude of these additional losses. Considering fixed charges as 15 per cent, the annual cost per kva. of capacity is $2.25. With a 50 per cent annual load factor this is approximately 0.515 mill per kilowatt-hour at unity power factor, or 0.855 mill at 60 per cent power factor. This is an increase of 0.34 mill per kilowatt-hour, which, if the total operating cost is 10 mills at unity power factor, means an increased cost of 3.4 per cent.



FIGS. 1 AND 2—MOTORING OF THESE LOADS ADJUSTED TO MAINTAIN HIGH POWER FACTOR

The copper losses in generators and transformers do not ordinarily run over 2 per cent, but in the distributing systems they may be almost anything. To be conservative it may be assumed that the copper losses at unity power factor are 5 per cent. With an energy cost of 10 mills this means a copper loss of 0.5 mill at unity power factor or 1.39 mills at 60 per cent power factor. This is an increase of 0.89 mill, or an increase in cost of 8.9 per cent, which added to the loss due to increased

fixed charges makes a total increased loss due to a 60 per cent power factor of 12.3 per cent. Obviously this is a loss worth considerable effort to save.

As long as the main electrical load is induction motors, which will undoubtedly be the case for some time yet, it cannot be hoped to raise the power factor to unity without corrective means, but it can be raised to between 80 per cent and 85 per cent, which would

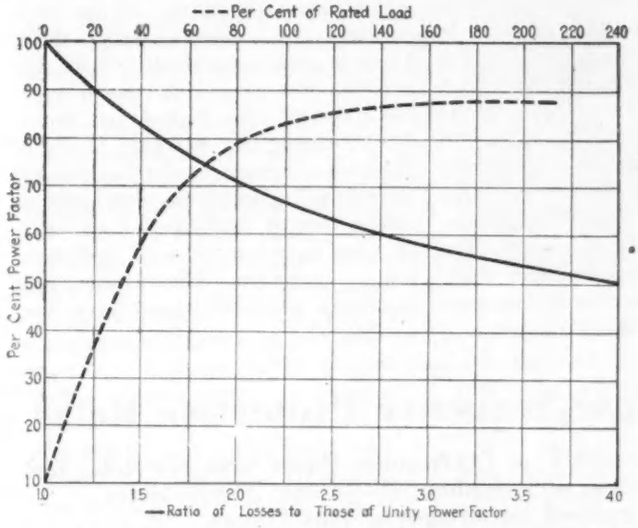

---Per Cent of Rated Load
0 20 40 60 80 100 120 140 160 180 200 220 240
100 90 80 70 60 50 40 30 20 10
Per Cent Power Factor
10 15 20 25 30 35 40
—Ratio of Losses to Those at Unity Power Factor

FIG. 3—CURVES SHOWING RATIO OF COPPER LOSSES AT LOW POWER FACTORS TO THOSE AT UNITY AND TYPICAL POWER-FACTOR CHARACTERISTIC OF INDUCTION MOTOR

cut this excess loss from 12.3 per cent to between 3 and 4 per cent.

A typical power-factor curve for a three-phase, 60-cycle induction motor is shown by dashed line in Fig. 1. Depending on speed, size and design, the curves for different motors will run a little above or below this, but the average will not be far from the curve shown. At full load it will be noticed that the power factor is a little more than 80 per cent, and at 25 per cent overload it is only 85 per cent. The only thing necessary, therefore, to keep the power factor up around 80 per cent is to run the motors fully loaded. At the present time the country and the world, for that matter, are suffering from an epidemic of underloaded motors. Cyril Sylvester pointedly discussed this matter in the London *Electrician* for June 20, 1924. As Mr. Sylvester says: "It would be economical to install motors for individual drives which are actually overloaded when developing the maximum load upon them. This would bring the average load much nearer to normal full-load conditions and an improvement in power factor would result."

The company with which the writer is associated has been attempting to do this for several years now with very appreciable effect. The two load curves shown in Figs. 1 and 2 show the result. Both of these curves represent actual tests on 600-hp. motors taken by use of a rotating standard read at one-minute intervals, and both represent the load as it exists all day long. Fig. 1 shows a high load factor of more than 78 per cent with a minimum load of 79 per cent rating and a peak load of 26 per cent overrating, the average load being 97 per cent rated load on the motor. Fig. 2 shows a comparatively low load factor of 57 per cent, but with the average load of 103 per cent of rated load. This curve has a minimum of 8½ per cent rated load and a peak of 85 per cent overload.

To permit loading motors in this manner the motors must be built for moderate full-load temperature rise. The heating of a motor is largely proportional to the square of the load. If the squares of the loads on the motors are plotted instead of the actual loads, the curve would be obtained which is shown in dotted lines, roughly representing the load from a heating standpoint. The average of this curve is a 15½ per cent overload instead of the 3 per cent overload of the original curve.

This shows very clearly the necessity of having liberal temperature ratings for general-purpose motors if they are to be operated so as to obtain good power factor and efficiencies. With such motors there is no danger in keeping the average load high, even though this may entail large short-time overloads. Short-time overloads of 100 per cent are not harmful to any well-built induction motor.

By thus keeping motors operating at an average load approximately equaling their rating a double advantage is gained—the power factor of the system is kept high and the excess losses of 12 per cent or more are cut to 3 per cent and the investment in motors is reduced, less horsepower capacity in motors being required.

Letters from Our Readers

"The Fynn Motors and a Predecessor"

To the Editor of the ELECTRICAL WORLD:

Upon my return from an extended bear hunt in Alaska my attention was directed to K. L. Hansen's letter under the above heading in your issue of May 30. I think all of his comments will be found to be well covered if my article is read with ordinary care.

The first two paragraphs of my article of April 18, 1925, and particularly the passage: "Close analysis had *long ago* disclosed the fact that the true solution, at least for the current motor sizes, must be looked for in a non-synchronous machine, but it was only after many years of study that a practical solution occurred to the writer," must surely convince Mr. Hansen that I, together with no doubt hundreds of others, had years ago decided in favor of the non-synchronous machine. Such being the case, and since we have all known of the Heyland motor for some twenty-five years, how is it that neither Mr. Hansen nor any one else has offered the Heyland machine to the public in response to the request for a unity-power-factor motor officially broadcast by the N. E. L. A. on Dec. 21, 1921?

Mr. Hansen asserts that my new motor is nothing but the old Heyland machine. In my preliminary, and so far only, announcement, I was careful to give enough data to enable those familiar with the art to recognize immediately the nature of the advance made over the theoretical machine of Heyland. In my view this advance has resulted in a commercial asynchronous unity-power-factor motor.

In my search for a commercial unity-power-factor polyphase motor I devised a plurality of synchronous induction motors, and I also devised several non-synchronous unity-power-factor machines, which I shall presently describe in detail. The fact that some of the synchronous solutions occurred to me before some of the non-synchronous ones is, I trust, not an unpardonable offense. If a better type of solution occurs to me, I shall do my best to squeeze it dry, even if it means a third series of machines.

VAL A. FYNN,
St. Louis, Mo. Consulting Engineer.

Central Station and Industrial Practice

Electric Heat Helps Produce High-Grade Brushes

BY S. L. LANG
Vice-President Wolfe Brush Company, Pittsburgh, Pa.

IN 1919 the Wolfe Brush Company began using electricity for heating its melting pots and ovens used in the manufacture of brushes and found in both cases that the results

ELECTRIC MELTING POT FOR COMPOUND HOLDING BRISTLES IN BRUSHES

warranted the initial cost of the installation.

The composition that fastens each bunch of bristles into the holes in a wooden back is heated in a cast-iron melting pot, 18 in. in diameter and 8 in. deep, mounted in the middle of a work table. Electric heat superseded gas for this process, with the result that working conditions have been greatly improved and the fire hazard decreased. The difficulties arising from shortage of gas pressure have also been eliminated.

Three Westinghouse steel-clad heaters totaling 1,950 watts are fastened to the bottom of this melting pot. Asbestos cement 1 in. thick insulates the pot and conserves heat. This insulation is protected by a galvanized-iron shell. Air is exhausted from over the top of the pot through a 4-in. galvanized pipe by means of a ventilating fan. Small bundles of bristles are dipped into a solution and then inserted in the wood base.

The heat is controlled by a three-heat snap switch. The composition is melted on a high heating rate in the morning and then kept at the proper working temperature on a medium heating rate.

Electric ovens are used for vulcanizing the compound in which the brush bristles are set. The bristles are first arranged in thin metal ferrules with the root ends projecting about ½ in. The roots are dipped in cement and the ferrules are then slipped over them far enough to allow the proper insertion of the handle after the cement has been baked. The baking is done with the bristles in an upright position. In order that high quality be maintained, it is necessary that this baking be done at the proper temperature. Overheating destroys the life of the bristles and makes them break off. We have found that electric heat permits us to maintain a very close temperature regulation, between 216 deg. and 230 deg F.

The average charge in an oven consists of about sixty dozen brushes, weighing about 250 lb. The brushes are placed in the oven in the morning and baked ten hours. About three and one-half hours of this time is required for heating up. Before we adopted electric heat, we found that it sometimes took three or four days per bake in periods of low gas pressure. Since electric heat has been installed, there have been no delays.

Use of Phase-Sequence Protective Relay

Field Experience with Type CQ Negative Phase Sequence Relay for the Protection of Polyphase Machinery Demonstrates Practical Advantages of This Theory

BY J. V. BREISKY
Supply Engineering Department
Westinghouse Electric & Manufacturing Company

IN THE COURSE of the last few years a new system of meters and protective relays for polyphase circuits has been proposed and several interesting articles have been published on this subject.[1] This new system is based on the theory of symmetrical co-ordinates and makes use of the fact that any unbalanced polyphase system of currents or voltages can be resolved into two or more balanced systems. Taking the case of an unbalanced three-phase, three-wire circuit, for instance, it can be resolved into two balanced components; one, rotating in the normal direction of rotation of the circuit, called the positive phase sequence component, and a second one, rotating in the opposite direction, called the negative phase sequence component.

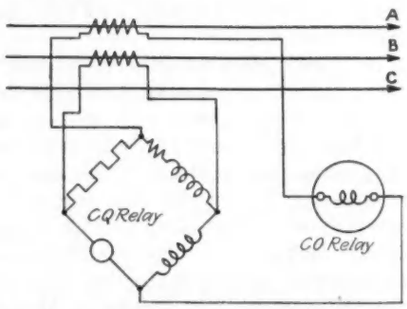


FIG. 2—PROTECTION GIVEN AGAINST ANY KIND OF ABNORMAL CONDITION

When the polyphase circuit is balanced, the negative phase sequence component is zero. On the other hand, the more severe the unbalance the greater the negative phase sequence component will become.

In the case of polyphase machines, it can be shown that the greater the negative phase sequence component the greater the amount of undue heating and mechanical vibrations will be. This fact was made use of by designing a relay for the protection of polyphase machinery which responds to negative phase se-

[1] "Methods of Symmetrical Co-ordinates Applied to the Solution of Polyphase Network," by C. L. Fortescue. *Transactions*, A. I. E. E., 1918, Vol. 37, p. 1027. "New Sequence System of Polyphase Meters," by R. D. Evans, ELECTRICAL WORLD, 1923, Vol. 81, No. 6.

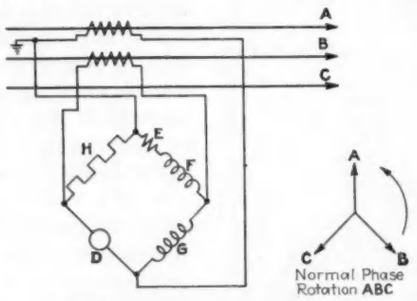


FIG. 1—SCHEMATIC DIAGRAMS OF EXTERNAL CONNECTIONS OF CQ RELAY

D = Induction type current relay element.
E and *F* = Impedance.
G = Reactance.
H = Resistance.

quence currents only and which can be set to operate on different values of this negative phase sequence current in a predetermined interval of time. This makes it possible to disconnect the machine on a predetermined severity of unbalanced conditions.

This relay, the type CQ, is the first device put on the market which uses this new phase sequence system and has proved to be an entire success.

The induction relay element *D* is the contact-making element, and the constants of the network *E* and *F*, *G*, *D* and *H*, Fig. 1, are so worked out that only negative phase sequence currents can travel through the branch *D*. The relay will close its contacts: (*a*) in case of a polyphase unbalance of a given magnitude; (*b*) in case of a phase failure at a given load condition; and (*c*) in case of a phase reversal. It therefore gives protection to a polyphase machine against any abnormal condition except a balanced overload or balanced short circuit. However, due to the relay having been designed on the phase sequence theory, just one overcurrent relay connected to one of the two current transformers will

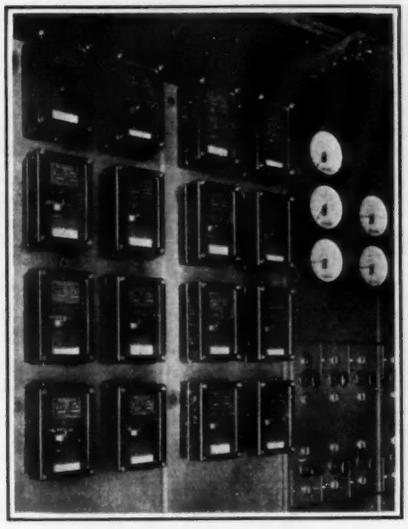


FIG. 3—INSTALLATION OF RELAYS AT CAHOKIA PLANT

take care of balanced overloads and short circuits, thus making protection as complete as possible (Fig. 2).

The first installation of this type was made last year at the Cahokia station of the Union Electric Light & Power Company of St. Louis, where fifty-nine of these relays were put into service, chiefly for the protection of motors, driving power house auxiliaries. Fig. 3 shows a typical installation at Cahokia. These relays have given entirely satisfactory service, thus establishing the value of the phase sequence theory as applied to protective apparatus.

Accurate Cost Estimates Facilitated

BY R. A. MILLER
Dayton (Ohio) Power & Light Company

PREPARATION of estimates is not only greatly facilitated by the time studies made of every job on the Dayton Power & Light Company's system, but more accurate estimates are made possible thereby, because the unit cost data on past jobs are recorded on job-analysis cards. These data, tempered with good judgment, serve as a basis for estimates; the unit costs are based on current conditions.

The accompanying form is used in the preparation of new line construction estimates, the actual items of labor, truck and material being printed thereon to avoid overlooking some of them. A summary in the estimate totals the estimated material, labor, administration and supervision expenses.

THE DAYTON POWER & LIGHT COMPANY
LINE ESTIMATE SHEET
(ORIGINAL)

Job No. .....
W. O. No. .....
Issued ..... 19..
Explanation of Work: .....

Prepared by ..... Date ..... Approved by ..... Date .....
Priced by ..... Date ..... Approved by ..... Date .....
Checked by ..... Date ..... Approved by ..... Date .....
Approved by ..... Date ..... Approved by ..... Date .....

SUMMARY

MATERIAL AND MISCELLANEOUS ITEMS	
LABOR	
TRUCK	
TOTAL	
ADMINISTRATION AND SUPERVISION	
TOTAL ESTIMATED COST	

LABOR ANALYSIS

OPERATION	MEN	HRS.	@	COST
Hauling Poles				
Setting Poles				
Guying Poles				
Framing & Treating Poles				
Installing X Arms				
Installing Insulators				
Stringing Wire				
Installing Transformers				
Installing Services				
Transferring X Arms				
Transferring Wire				
Trimming Trees				
Hauling Brush				
Street Lg. Misc.				
Lobby to and from Job				
Special Labor				
Labor Crew				
Line Crew				
Digging Post Holes				
Digging Anchor Holes				
Setting Anchors				
TOTAL LABOR				

TRUCK ANALYSIS

OPERATION	TRUCK	HRS.	@	COST
Hauling Poles				
Setting Poles				
Hauling Line Mat'l				
Stringing Wire				
Hauling Transformers				
Hauling Brush				
Hauling St. Lg. Mat'l				
Trans. to and from Job				
Special Hauling				
Labor Crew Truck				
Line Crew Truck				
TOTAL TRUCK				

MATERIAL AND MISCELLANEOUS ITEMS

MATERIAL	Quan.	Unit Cost	Total Cost
Wire, Copper No. Bs.			
Wire, Copper No. Bs.			
Wire, Copper No. Bs.			
Wire, Copper No. Bs.			
Wire, Copper No. Bs.			
Iron Wire—Galv. No.			
Iron Wire—¼ in. Strand			
Iron Wire—⅜ in. Strand			
Tie Wire			
Poles—25 ft.			
Poles—30 ft.			
Poles—35 ft.			
Poles—40 ft.			
Poles—45 ft.			
Poles ft.			
Poles ft.			
X-Arms—1 Pin—Comp.			
X-Arms—4 Pin—Comp.			
X-Arms—6 Pin—Comp.			
X-Arms			
Brackets No.			
Insulators—600 V.			
Insulators—13,000 V.			
Insulators—Pors. No.			
Insulators—Strain No.			
Insulators			
Steel Bolts			
Thru Bolts x			
Thru Bolts x			
Double Eng Bolts x			
Double Eng Bolts x			
Washers, Square			
2-Bolt Guy Clamps			
Dead End Clevis			
U-Irons			
Shim Plates			
Anchor Rods x			
Anchor Slugs			
Screw Anchors			
Screw Anchors			
Thimbles			
Guy Wire Protectors			
Total Forward			

MATERIAL	Quan.	Unit Cost	Total Cost
Total Brought Forward			
Pole Steps			
Ground Pipes			
Pole Steadying			
Primary Cut-Outs			
Lightning Arresters			
Lightning Arresters			
Steel Arms Ft.			
Pole Pulleys			
Span Pulleys			
Paint—Gallons			
Series Lamps:			
C. P.			
C. P.			
K.V.A. Transformer Phase V.			
K.V.A. Transformer Phase V.			
K.V.A. Transformer Phase V.			
K.W. Compensator V.			
Consistency Supplies			
Portable			
Carbons			
Right of Way			
TOTAL MATERIAL			

FORM OF ESTIMATE SHEET USED FOR LINE CONSTRUCTION
11x16 in. triplicate; white to accounting department, yellow to foreman, pink to estimator

Motor-Driven Sand Screens Increase Production

THREE motor - driven sand screens, using fractional-horsepower motors, replaced seven engine-driven screens, with a 50 per cent increase in production and the saving of one man's labor, in the plant of the Ottawa Silica Company, Ottawa, Ill. The screens referred to are in the "standard sand" department, where the highest grade of testing sand is prepared, the specifications requiring the sand to pass a 20-mesh screen and to be retained on a 30-mesh screen. The old screens were driven by belts from line shafting, occupying considerable space and requiring considerable maintenance. The new screens are self-contained units, suspended from the ceiling, direct-connected to small motors and requiring a minimum of attention. Power for the motor-driven screens is supplied by the Illinois Power & Light Corporation as part of the complete electric service to this important silica sand plant.

Celluloid as a Substitute for Tracing Cloth

A TRANSPARENT celluloid to be used as a substitute for tracing cloth where permanent drawings are subject to frequent and minor alterations has been developed and is being used by several large operating companies. It is particularly useful where records, maps, connection diagrams and similar information must be kept up to date continuously and where periodic reproduction in quantities for use by office and field men is necessary. The greatest advantage comes from its use for large and complicated drawings in which small elements are being altered frequently so as rapidly to wear out the usual tracing cloth.

Examples of uses that may be made of the celluloid are: (1) Diagrammatic routes of overhead and underground feeder, street lighting and distribution circuits; (2) connection diagrams for extensive power-distributing systems; (3) detailed connection diagrams for feeders from large generating stations to substations; (4) tabulations of capacity ratings on large transmission systems, particularly when changes are frequent, and (5) details of connections to large customers.

The first cost of celluloid is greater than tracing cloth and more time is required to prepare the surface and make the tracing, because of the greater care that is needed to insure a good job. Ink drys more slowly on celluloid and does not follow the pen as readily as on cloth, and unless the work is well done the ink may flake off after drying. The thickness is about 0.015 in. One side has a smooth finish, and the other a mat surface, the latter being that upon which the tracing is made.

Tracings made by this method are almost indestructible, since the ink lines may be removed easily with a sharp scratcher with no injury to the celluloid surface. Drawings are still in perfect condition that were made in 1907, upon which all the extensions of and alterations to one of the largest distribution networks in this country have been and still are being indicated. Prints have been made at either three or six months intervals throughout this period in sufficient quantities to supply dozens of copies to installation and maintenance forces. The sheets are filed in steel cabinets and are laid flat with no separators between them.

Electric Generating Plant Loads

Several Nebraska Communities Analyzed as to Daily Consumption Characteristics—Question of Diversified Customers Considered in Detail

BY V. L. HOLLISTER
Lincoln, Neb.

THE ACTUAL power consumption of small cities and villages, the figures needed by designing engineers in the preparation of estimates as to present or probable future electric power consumption in a small community, are seldom published with a sufficient statement of the surrounding and governing conditions to make them valuable even as guides. The following curves and data show the results of a study made preliminary to writing a report upon the engineering economics of an electric lighting plant for a city of 3,000 population in the state of Nebraska.

The number of kilowatt-hours sold annually varies with the population, the cost of coal, freight rates, electric rates, amount of rainfall, amount of irrigation needed, presence of industrial and manufacturing plants and various other factors too numerous to mention.

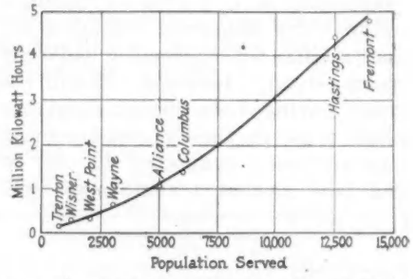


FIG. 1—TYPICAL OUTPUT OF SEVERAL NEBRASKA COMMUNITIES IN 1923

Cities of 50,000 to 200,000 population in the wheat belt of the Middle Western states consume between 600 kw.-hr. and 800 kw.-hr. per capita per year. Villages ranging in population from 150 to 800, in good agricultural districts, consume from 100 kw.-hr. to 150 kw.-hr. per capita per year.

In the dry, semi-arid regions, where lawns must be irrigated, the electrically driven water pumps of

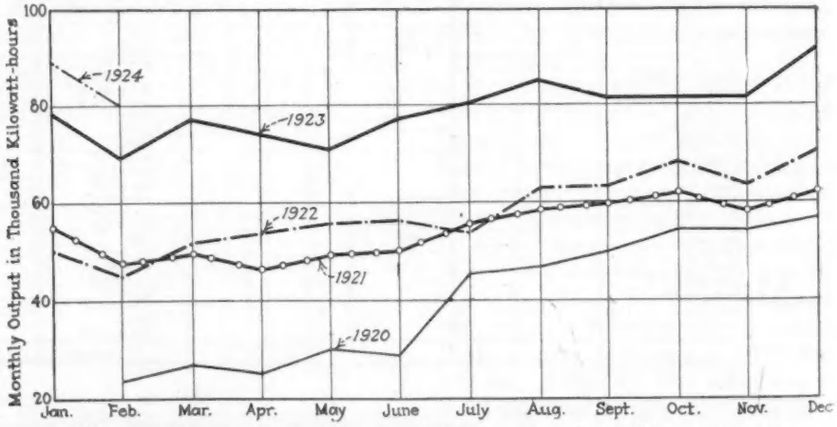


FIG. 2—MONTHLY LOAD CURVES OF NEBRASKA TOWN OF 3,000 POPULATION

the community may demand an amount of electric power equal to all other uses. Small hydro-electric plants selling electric power for heating purposes at low rates in regions of relatively high local coal costs have loads as high as 375 kw.-hr. per capita per year, where the population ranges from 1,500 to 2,500. Small direct-current systems fall very much below the average figures for alternating-current plants located in communities of equal population and similar industrial features.

A compilation of data from various public records is shown in Fig. 1. The scale of population (horizontal) and the scale of kilowatt-hours total (vertical) are chosen to show the general trend of the electric power consumption in cities, towns and villages located in an agricultural state with a minimum of industrial power applications. The figures hold good for several other towns that have come under observation recently.

The designer is not safe in assuming that the electrical load will increase from year to year directly as the population increases. The power consumption of the larger cities in the Middle West has been increasing at a rate of about 15 per cent per year; the load doubles about every five years.

The history by years of the growth of the electrical load on a plant in the general region of the corn and wheat belt is shown in Fig. 2. The plant started in a community of 3,000 population in February, 1920. A competitive electric generating system existed and remains in operation in this community, serving about one-third of the consumers. The rate of load growth on this plant does not represent the increase in electrical power use in this city, because a large part of the increase is due to a loss of customers by the competitor. The large increase during the year 1923 was due to motorizing a local industry.

A monthly record by days of the peak load on a particular plant serving a population of about 3,000 people is shown in Fig. 3. The maximum daily peak loads experienced during the months of June and December are superimposed upon one sheet for comparison The plant operator distinguishes between the average daily peak load, which generally occurs at night, the Saturday

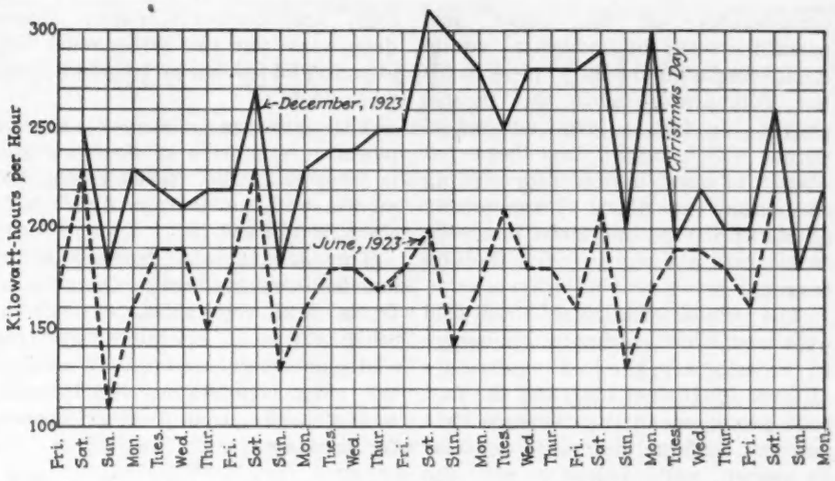

Kilowatt-hours per Hour
300
250
200
150
100
December, 1923
June, 1923
Christmas Day
Fri. Sat. Sun. Mon. Tues. Wed. Thur. Fri. Sat. Sun. Mon. Tues. Wed. Thur Fri. Sat. Sun. Mon. Tues. Wed. Thur. Fri. Sat. Sun. Mon. Tues. Wed. Thur. Fri. Sat. Sun. Mon.

FIG. 3—DAILY PEAK LOAD CURVE IN AGRICULTURAL COMMUNITY OF 3,000 PEOPLE

night peak, and the extraordinary Christmas peak. This curve brings out clearly the high peak loads of the holiday season that occurred on Saturday night just previous to Christmas. Saturday night's peak load is always followed by light Sunday peaks and low power consumption.

To bring out more forcibly the load variation from day to day, Fig. 4 is given. The month is June, the community has a population of 3,000, and no special extraneous conditions existed. Washings and ironings are very largely done at home in this community. The farmers come to town on Saturday night. There are no electric stoves in this community. Some electric pumping is done at night, and Wednesday is the preferred ironing day.

The item of average peak load is a vital one in selecting machinery for an electric power plant. It is a figure generally quite difficult to obtain, as the average small plant is not equipped with an indicating wattmeter. Hourly readings of a watt-hour meter merely indicate average maximum kilowatt-hours per hour when the largest figures are taken. Observations on several plants have been tabulated and plotted against population. A straight line can be drawn through these points showing that the relation between peak load and population is direct.

It must not be assumed that the experience of all plants would bear out the straight line law. A small city with about 100 electric stoves installed shows a peak electric load

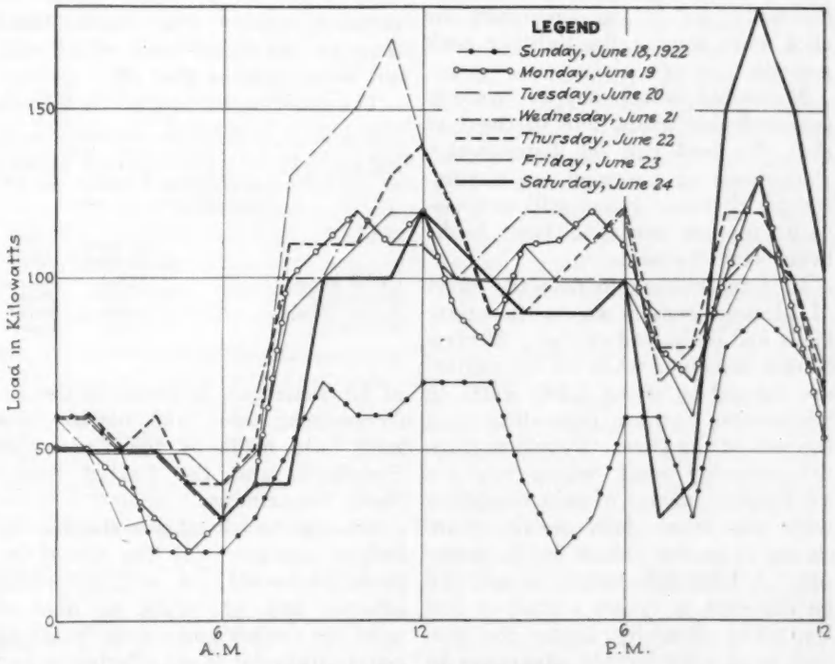


FIG. 4—DAILY LOAD CURVES

considerably off the curve, and certain classes of industrial equipment create momentary peak loads not comparable with the figures shown. In fact, a large number of points which might have been put upon the curve sheet, representing the actual experience of community plants of diverse industrial interests, would create a picture of a shotgun target.

The number of kilowatt-hours sold each month varies, due to the change in the solar day, the local enterprises affected by the seasons, and the fact that people spend their leisure time indoors during the cold weather. December and January are the months of the greatest power sales for lighting and cooking. March and October are generally considered average load months. However, certain power applications may determine the relative monthly loads. In the territory here considered we have electric motors serving particular industries which are controlling as to the total monthly power generated and sold, as well as to the peak demand.

MISCELLANEOUS FEATURES

Small sand and gravel pumps are equipped with motors of from 125 hp. to 250 hp. The load is extremely variable. The starting currents are often excessive for plants of less than ten times the motor ratings.

Ice plants operate approximately 200 days per year, and operate throughout the twenty-four hours during the season. This load is very desirable, as it can generally be shut down during the lighting peak periods.

Municipal water supply systems are desirable loads, due to the fact that the load can be dispatched—shut down or operated, as circumstances dictate. Some mill and elevator motors are long hour loads, hence very desirable.

It is interesting to note the effect of electric ranges as to the peak loads and daily load curves. Electric ranges consume, when all "elements" are turned on, from 3,500 watts to 7,500 watts or more, depending upon the size of the stove. People prepare the noon-day meal, which requires the largest amount of heat compared with the other daily meals, from eleven to twelve o'clock in the morning. A hundred electric ranges can be expected to create a load of 100 kw. The diversity factor for this load is of considerable advantage to the central generating plant: however, transformer capacity, house drop wires and line wires must necessarily be adequate to meet these peak loads.

The average observed electric power consumption of electric stoves is from 75 kw.-hr. to 200 kw.-hr. per month, with an average figure very close to 100 kw.-hr.

The summer is the period of heaviest cooking load. Canning of fruits and vegetables, absence of other stoves in operation, and the cool atmosphere surrounding an electric range, contributes considerably to the consumption of electric power for cooking.

A Recent Development in Rustproofing

BY L. F. HIRSCH

Chemical Engineer,
Philadelphia Rust-Proof Company

THE importance of rustproofing has long been appreciated by maintenance engineers who handle equipment exposed to the elements. Manufacturers of this equipment have also carried on a great deal of research along this line, and it is interesting to note the results of tests of a rustproof process by the National Bureau of Underwriters. This patented process is named Udyliting, after M. J. Udy, its inventor, and is controlled by Udylite Process Company, Kokomo, Ind.

The process consists of treating the surface with cadmium and amalgamating it with the metal rather than forming an outer shell. It forms a silvery gray finish which may be burnished and which will not scale, chip or peel off.

The condensed report of the Bureau of Underwriters is given in the accompanying table, and similar tests have been made by the Bureau of Standards and the United States Navy Department.

EXTRACT FROM EXTINGUISHER REPORT NO. 77 OF NATIONAL BUREAU OF UNDERWRITERS

	Hours in Salt Spray	Result
Udylite process	1,860	No rust
Zinc plating	316	Rusty
Hot galvanizing	650	Rusty
Sherardizing	367	Rusty

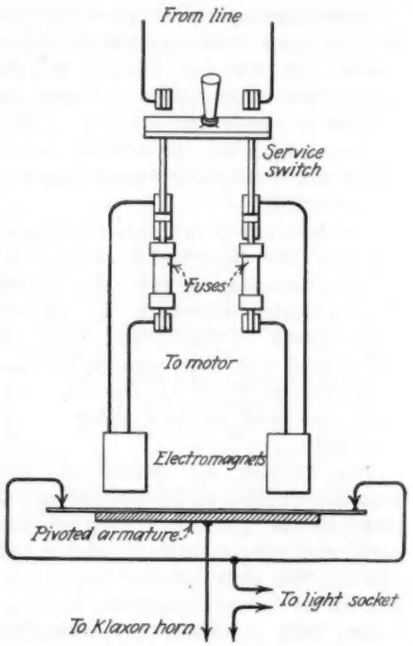
Among the advantages claimed for this process are: (1) The size of the parts processed are not materially affected and (2) since no heat is used the temper and elasticity of the parent material is not affected to any extent.

Rupture of Pump Service Fuses Operates Signal

BY W. G. SHURGAR

Superintendent of Power Stations, Arkansas Central Power Company, Little Rock, Ark.

THE make-up water pump delivering treated water to the boilers of the Arkansas Central Power Company's plant at Little Rock is in a building separate from the station; therefore, it does not come under frequent supervision of the plant force. Since blowing of the fuses in series with the service switch might interrupt operation of the pump long enough to be serious if not brought to the attention of the operators promptly, a home-made signaling device has been made to blow a Klaxon horn in case either fuse blows.



CONNECTION OF MAKE-UP WATER PUMP SIGNALING DEVICE USED BY THE ARKANSAS CENTRAL POWER COMPANY

The signaling device consists essentially of two electromagnets, acting on a contact-carrying armature pivoted at the center. One electromagnet is connected across one pump service fuse and the other across the other fuse.

The armature of this signal device is connected to one side of the signal circuit and the stationary contacts to the other side. If either fuse ruptures, voltage is impressed across the corresponding electromagnet, which attracts the armature shown in the accompanying illustration and closes the signal circuit.

Commercial Activities and Public Relations

Electric Range Servicing and Complaint Costs

DATA showing the total cost of maintaining and servicing the electric ranges on the lines of a large central-station company on the Pacific Coast during the years 1923 and 1924 have been collected by the electric cooking and heating committee of the N.E.L.A. These data cover a total of nearly 4,000 range installations, a sufficient number to make possible the averaging of over-all service costs per range without being affected by any unusual or extraordinary conditions. Table I shows the total yearly cost of servicing ranges and also the cost of handling individual complaints.

The company services ranges without charge to its customers regardless of the length of time they have been installed. This service is costing approximately $20,000 per year, but this expense could be greatly reduced if its customers were billed for material and labor, after the guarantee of one year had expired, on some satisfactory basis.

TABLE II—ELECTRIC RANGE SERVICE CALLS BY MONTHS

Month	1923	1924	Month	1923	1924
January	20	18	August	23	18
February	25	16	September	26	29
March	27	18	October	19	15
April	22	25	November	16	3
May	30	20	December	16	2
June	30	15			
July	20	18	Total	272	197

The furnishing of free service indefinitely will work a hardship, since this expense will increase year by year as the average age of the ranges installed increases. When the users of electric ranges understand that charges are made for servicing, the amount of this work is reduced due to the greater care exercised in handling the ranges and to the fact that many range owners will take care of minor troubles themselves.

Accurate data were obtained from another company covering its service calls for the entire years of 1923 and 1924. Table II, showing a part of the number of service calls each month, is interesting, since it shows the variation in the number of calls that can be expected over a twelve-month period.

The spring and summer months apparently are the ones when the greatest number of service calls are made, and the number of calls decrease with the winter months, reaching their lowest point during November and December. This decrease is probably due to a decrease in the use of the electric range during the winter months in those homes where a furnace is not installed and some method is required for heating the kitchen.

Sell Appliances, Not the Weather

How the Empire District Electric Company Manages Its Outside Sales Force to Get the Best Results for Both the Company and the Salesmen

AT THE beginning of the last year the new business department of the Empire District Electric Company at Joplin, Mo., decided that it should be doing more appliance business, considering its opportunities. Accordingly the company launched a year's program to increase appliance sales, and the points especially watched in this drive were the so-called little things in selling, such as talking about the weather and politics. The fact that this company sold nearly $200,000 worth of appliances during the year, representing an increase of more than 100 per cent over the same period two years before, shows that the plan was not far wrong.

"Too much friendship is not good for the appliance business," says G. W. Rauch, assistant head of the new-business department of the Empire District Electric Company. "We have found that our house-to-house salesmen can become too familiar with their territory for their own good and for the good of the company. This is especially true of the suburban towns we serve. It does not take a salesman long to become so familiar with his territory that he knows a great part of the people in it personally, and he thinks he knows who are live prospects and who are not. He likewise discusses politics and the weather more freely with the people with whom he is personally acquainted."

Mr. Rauch cited an instance of a salesman in one small town—a town of about a thousand people, a large number of whom were miners. The man had been on the territory for about six months. At first he made an excellent sales record. Later, however, he did not do so well. When asked about his record, the salesman stated, and honestly too, that he was sure that his territory had reached the saturation point—that there were no more good prospects.

The sales manager switched him to another district and put on an-

TABLE I—ELECTRIC RANGE SERVICE AND COMPLAINT COSTS

Yearly Service Expense	Average Number Ranges	Labor Cost	Material Cost	Cartage Cost	Total Cost	Labor Cost per Range	Material Cost per Range	Cartage Cost per Range	Total Cost per Range
1923	2,348	$5,600.12	$8,414.01	$1,545.21	$15,559.34	$2.38	$3.59	$0.66	$6.63
1924	3,972	9,388.87	10,590.99	1,973.44	21,953.20	2.36	2.67	0.50	5.53

Costs per Complaint	Total Complaints	Ave. Ranges in Service	Complaints per Range	Labor Cost	Material Cost	Cartage Cost	Total Cost	Labor Cost per Complaint	Material Cost per Complaint	Cartage Cost per Complaint	Total Cost per Complaint
1923	6,059	2,348	2.5	$5,600.12	$8,414.01	$1,545.21	$15,559.34	$0.92	$1.39	$0.26	$2.57
1924	8,956	3,972	2.4	9,388.87	10,590.89	1,973.44	21,953.20	1.05	1.18	.22	2.45

other man. The new man didn't know a soul in the town, so he had to start from the ground. He had no knowledge as to who in that town could afford appliances and who could not. So, not knowing any better, he sold fifteen ranges and a number of other appliances in a comparatively short time. The man who formerly had this territory went into another that was likewise oversold, according to the man who had it before him, and he too did exceptionally well.

In both cases it was simply a matter of getting the men into new territories where they couldn't talk about the weather and other trifles, not knowing any one well enough to be sidetracked into such conversation. Nor did they know their prospects well enough to form an opinion as to who could and who couldn't buy.

"We switch our salesmen at least every six months," Mr. Rauch says, "whether they are working suburban or city districts, and we find that it invariably pays. Instead of an intimate knowledge of a district being an aid to a salesman, we find that it is a handicap.

HOUSE-TO-HOUSE CANVASSING

Mr. Rauch declares that his company has never discovered any royal road to a good prospect source, and he believes that a straight house-to-house canvass, with common sense used in eliminating needless calls, is as good a plan as any. However, salesmen are supplied with lists of cut-outs and cut-ins in their territories daily, and naturally these are the source of excellent prospects for appliances.

Another good source is through users of the company's appliances. When a salesman places a toaster, a fan or a heater with a customer, in about a month he goes back to inquire if the article is functioning satisfactorily, and incidentally inquires as to whether or not the customer has any neighbors who would likely be interested in an appliance like the customer's. Many times the salesmen get one or more prospects of first water in this manner.

Each salesman has a notebook in which he lists all his prospects secured from various sources. The company sends out a considerable amount of direct mail advertising to assist the men in getting interviews and closing the deals. On rainy days, when it is impractical for the men to be out calling from house to house, instead of sitting around waiting for the weather to clear up, they address appropriate advertising matter to their prospects.

The company has learned from experience that the so-called "saturation point" of a given appliance is more imaginary than real. An experience during the last year illustrates this point.

The manufacturer of a well-known electric iron sent his salesman to Joplin to put on a campaign. The company's new-business department looked through its records on iron sales and turned down the offer of a special drive on the part of the manufacturer. "We have reached the saturation point on irons temporarily," the salesman was told. "Our records show that there is an iron for virtually every house in the city."

But the salesman was not satisfied. He prevailed upon the company to let him put on the drive anyway. He printed a number of cards featuring the irons and had one hung on every doorknob in the city. Then he sent out several hundred broadsides, with a return post card, unstamped, whereby the recipient could ask for a demonstration.

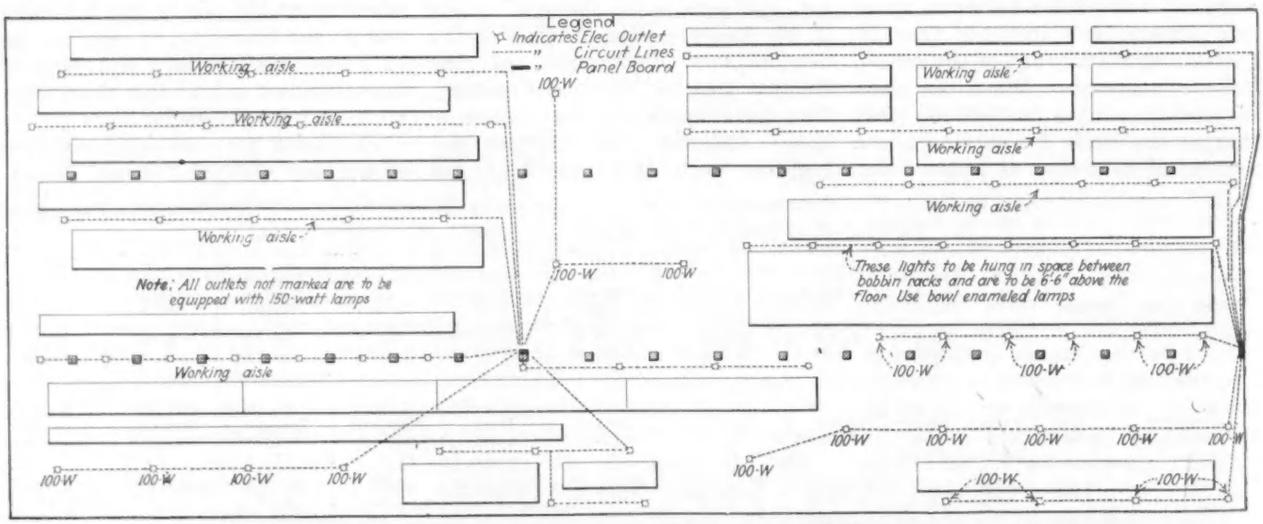
The new-business managers were certain that the irons would not sell through advertising alone, if at all. The salesman was equally certain that they would. Both were wrong.

Only three of the cards came back requesting demonstrations, and there was no response from the cards on the doorknobs. But the local company decided to co-operate with the manufacturer to the extent of sending out house-to-house salesmen, since the manufacturer had gone thus far with the campaign. As a result of the combined effort the salesmen disposed of 540 electric irons in a few days in a district that had supposedly reached the saturation point.

Improved Lighting in Silk Mill

Central-Station Lighting Service Department's Recommendations Bring Improved Lighting and Increased Load

MANY central stations have organized lighting service departments to give expert illuminating engineering service to their customers. Such a department is particularly valuable in making recommendations and drawing up specifications for modernizing antiquated and inadequate installations in industrial plants. A typical example of this type of service is that of the specifications drawn up by the lighting department of the Public Serv-



SPECIFICATIONS DIAGRAM SHOWING LOCATION OF OUTLETS AND ARRANGEMENTS OF WIRING CIRCUITS

FIG. 1—SPEEDERS AND WINDERS DEPARTMENT WITH THE OLD LIGHTING

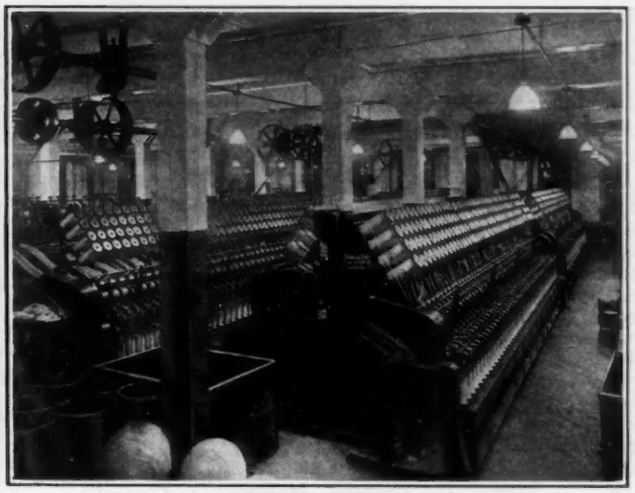


FIG. 2—A CLOSE-UP VIEW OF THE MACHINERY UNDER GOOD LIGHTING

ice Electric & Gas Company for modern lighting in the spinners and winders department of the F. A. Straus Company silk mill at Trenton, N. J.

The illuminating engineer assigned to making up the specifications first covered the economics of better lighting and showed the great increase in production compared with the cost of the installation which research shows follows improved lighting.

The specifications emphasize the fact that replacement lamps should be of the voltage originally installed, and that a careful schedule of inspection should be carried out to replace all blackened and burned-out lamps. All lamps and reflectors should be cleaned at intervals of not more than six weeks. The accompanying diagram shows the location of outlets. They have been located in this case with respect to the working aisles, but the locations and mounting heights are designed to give good lighting along the rear aisles as well. The specifications recommend two panels and the wiring circuits shown in the diagram.

The average value of illumination provided at a height of 30 in. above the floor will be: Speeders and winders, 7 to 8 foot-candles and 1.36 watts per square foot; gill boxes and general lighting, 6 foot-candles.

The diagram shows the size of lamps recommended for each outlet and also the circuit diagrams and control panels. No. CSE-100 Holophane reflectors were named for this job and are to be installed 9 ft. above the floor.

The total equipment required consists of twenty-three 100-watt Mazda C lamps, clear; fifty-two 150-watt Mazda C lamps, clear; eight 150-watt Mazda C lamps, bowl enameled; sixty Holophane reflectors No. CSE-100. The cost of the fixtures and fittings was $126, and wiring and labor $496.80, a total of $622.80.

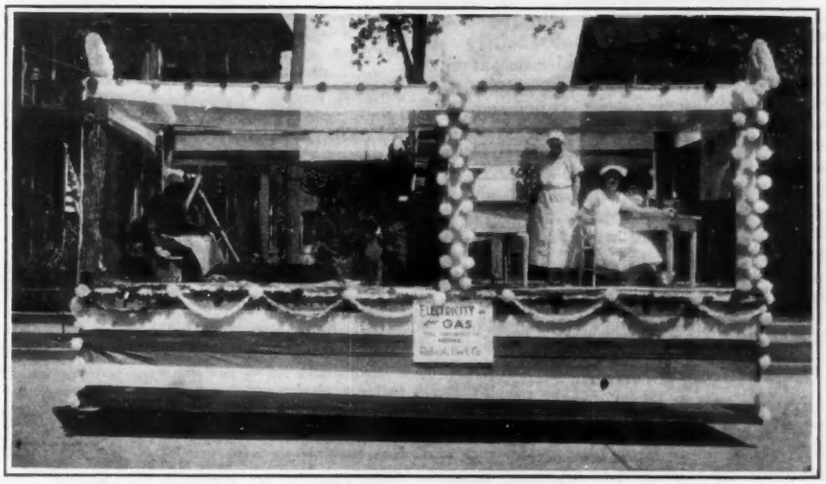
The total connected load before the change was 6 kw., which increased to 11.3 kw. after the improvement. The monthly energy consumption, however, rose only from 198.5 kw.-hr. per month before to 248 kw.-hr. per month afterward —an excellent economy in view of the change from spotty, low intensity lighting with some glare to even, abundant, well-diffused light, with its consequent increased production by the mill workers.

Electric Trucks Replace Horses in Richmond

TWENTY horse-drawn delivery wagons, now covering the Richmond, Va., city routes for the Chapin-Sacks Corporation, ice-cream manufacturer, will be replaced by ten electric delivery trucks of the latest design, according to an announcement made by an official of the company.

The new trucks have been tested thoroughly and have given most satisfactory results. They will be placed in the regular city delivery service immediately and the horses and old equipment will be sold at auction.

Improvement in Kitchen Equipment Portrayed



DURING a centennial celebration held in Paducah, Ky., on June 25 and 26 the Paducah Electric Company, Inc., entered a float in an industrial parade which showed the marvelous development in kitchen equipment from pioneer days to modern times. The front end of the float represented a log cabin, showing an old-fashioned fireplace with the pots, pans and kettles in place.

The other half of the float was a modern kitchen equipped with an electric range, washer and smaller electrical appliances and an automatic gas water heater.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Increase in Thermal Efficiency Due to Resuperheating in Steam Turbines.—W. E. BLOWNEY and G. B. WARREN.—The results of a large number of tests on turbines at different superheats have been analyzed to form a basis for calculating the gain in thermal efficiency due to resuperheating. They show that the heat consumption of a turbine installation may be decreased from 6 to 7 per cent as a result of resuperheating the steam. The gain possible by going to more than two stages of superheating, when taking into account the pressure drop in the resuperheaters, would be very small. The effect of resuperheating upon the exhaust conditions and capacity of the turbine is discussed. Curves are presented to show that the gains due to the resuperheating and the regenerative cycles are very nearly independent of each other and will be nearly additive.—*Mechanical Engineering*, June, 1925.

Largest Seven-Foot Head Hydro-Electric Plant.—The remarkable feature of this plant on the Rock River at Dixon, Ill., is the unusually low head at which it operates. The installation consists of five 800-kva., 2,300-volt or 4,000-volt, three-phase, 60-cycle vertical-shaft generators, each directly connected to a single-runner turbine, with draft tube of the Moody spreading type. The plant is operated by two men as a baseload plant in conjunction with a nearby steam plant.—*Power*, July 7, 1925.

Total Heat of Superheated Steam at High Pressures.—H. L. CALLENDAR.—The article describes a direct method of measuring the total heat of steam, which the author states has already been applied successfully at moderate pressures and promises to give good results with almost equal facility at the highest pressures attainable, if the difficulty of regulating the pressure can be surmounted. Three types of apparatus were employed—(1) differential throttling calorimeter, (2) differential electric calorimeter and (3) jacketed condenser. Each of these is explained, with diagrams and a critical discussion of its advantages and limitations. Finally there is an analysis and comparison of recently published steam tables and the corresponding formulas for total heat at saturation.—*World Power*, June, 1925.

Generation, Control, Switching and Protection

Wind-Power Plants.—K. LUBOWSKY.—A number of reliable constructions for wind-turbine-driven electric power plants are available today which can be recommended for places where wind velocities of 6 m. to 7 m. per second prevail for an average of 2,000 hours a year. Two types of equipment are being built, a heavy, slow-moving wheel, driving, over proper gears and shafting, a dynamo in the shed below the tower, and a high-speed wheel with a weatherproof dynamo built into the hub of the wheel. The former type is for outputs exceeding 3 kw., the latter for those not exceeding 3 kw. It is claimed that these plants give a higher over-all efficiency and have a longer life than gasoline-driven units. The useful output in kw. may be computed approximately with the formula $L_{kw} = Fv^3/3{,}200$, where F is the wheel diameter in meters and v the wind velocity in meters per second. This formula includes all mechanical and electrical losses. In cases where water has to be pumped into an elevated tank it will be found economical to place the wind wheel on a high mountain near by, have it drive a series generator, and operate the pump in the valley by a series motor. The author believes that 100 kw. represents about the highest economical output of a wind-electric plant.—*Elektrotechnische Zeitschrift*, June 25, 1925.

Grounding of Neutral.—F. CORNU.—The author reports in this paper on the excellent results obtained after dead-grounding the neutral of an extended overhead line, three-phase, 15,000 volts and 230 km. (140 miles) in length, joined to an underground 130-km. (78-mile) cable trunk. Previous to the Y-point grounding the network was operated completely insulated from ground and gave rise to frequent cable punctures and insulator failures. A very decided improvement was noticed after the plant was changed to solid neutral grounding. The short circuit which will occur in such networks when one of the phases becomes accidentally grounded may, if necessary, be lessened by the insertion of an ohmic or inductive resistance in the ground connection. A number of oscillographic measurements were made before and after the change-over above described, in order to study the ground current at various operating conditions.—*Revue Générale de l'Electricité*, July 4, 1925.

Transmission, Substations and Distribution

Mechanical Characteristics of Transmission Lines. — VI — Transmission Towers—Fundamental Considerations.—L. E. IMLAY.—Previous installments of this serial have been noted. The present part takes up tower design. Wind pressure on the tower itself is first considered. A number of the formulas that have been proposed for computing the pressure on a flat surface—Langley's, Smeaton's, Eiffel's and that of the United States Weather Bureau—are quoted, with data and suggestions regarding pressure on curved surfaces and latticed structures and the effect of the height of the tower. Other topics are the effect of temperature, ice and sleet and a discussion of the extent to which the design of the tower should allow for abnormal conditions. Without going into detail regarding the structural design of the towers, the author does deal briefly with unit stresses, the application of Euler's formula for long, slender members, the "end fixation factor" as determined by the Bureau of Standards, and the real margin of strength obtained with a given factor of safety.—*Electric Journal*, July, 1925.

Overvoltage on Transmission Systems Due to Dropping of Load.—E. J. BURNHAM.—This paper, which contains a number of charts, oscillograms and other data obtained by tests on an 8,500-kva., 6,600-volt water-wheel generator connected to a large 60-cycle system through an 18,000-kva. bank of transformers and a 40-mile, 66,000-volt transmission line, was also published in the June number of the *A. I. E. E. Journal* and was presented at the annual convention of the Institute at Saratoga Springs. An abstract may be found in the report of the convention in the ELECTRICAL WORLD, July 4, 1925, on page 19.—*General Electric Review*, July, 1925.

Units, Measurements and Instruments

Measuring Radio Frequency by Means of a Harmonic Generator.—AUGUST HUND.—This method is used for calibrating wavemeters. The generator makes use of the fact that a particular circuit produces strong harmonics, especially when much inductance with pronounced distributed capacity is used in the grid and plate circuits and a crystal rectifier in the output branch. The fundamental frequency is adjusted to equality with that of a tuning-fork generator giving a known audio frequency. The harmonics, up to the one-hundredth or even higher, are used to obtain resonance settings on the wavemeter to be calibrated. The method involves the use of visual indicating instruments for keeping the fundamental exactly at that of the fork, a heterodyne set to a frequency in the neighborhood of that to be used in the calibration, a six-stage amplifier for the beat effects and a visual resonance indicator. This apparatus is described, the manner of using it is explained, and circuit diagrams are shown. Since the harmonics are exact multiples of a frequency which can be known to a considerable degree of precision and the indications of resonance are sharp, the method is an accurate one.—*Proceedings of Institute of Radio Engineers*, April, 1925.

Separate Leakage Reactance of Transformer Windings. — O. G. C. DAHL.—An abstract of this paper may be found in the report of the annual convention of the A. I. E. E. in the ELECTRICAL WORLD, July 4, 1925, on page 19.—*Journal A. I. E. E.*, July, 1925.

"K-M" Chart for Computing Electromagnetic Induction Between an Aërial Line and Neighboring Circuits. — R. MITSUDA and K. KASAI. — A method is presented whereby the computation of induced electromotive forces on communication circuits due to currents in adjacent power circuits becomes a matter of simple arithmetic. The mathematical basis is first developed. It leads to an equation between three quantities which, plotted as a series of curves, constitutes the "K-M"

chart. To show how the chart is used in practice an illustrative numerical examination is worked out. When the relationship between the disturbing and the disturbed line changes at various points, as is usually the case, each section is computed individually in tabular form, and the total volts induced per ampere of disturbing current are obtained directly by addition.—*General Electric Review*, May, 1925.

Illumination

Studies in the Projection of Light.—Part XVII.—FRANK BENFORD.—The subtitle "Design Data of Ellipsoids and Hyperboloids" indicates the subject matter of this installment of the long serial on reflector design. At the end the author has tabulated a series of equations so that an ellipsoid or hyperboloid may readily be computed from three given properties, such as the light collecting angle, the width of beam, the eccentricity or the length of the axes.—*General Electric Review*, July, 1925.

Nela School of Lighting.—Equipment for demonstrating suitable lighting for various purposes is described and illustrated.—*Nela Booklet G-2, National Lamp Works of General Electric Company.*

Motors and Control

Gasoline Dynamo.—W. KRAUS and H. LÖWL.—For the supply of isolated farms an exceedingly simple gasoline-driven dynamo has been developed, requiring a minimum of attention. A one-cylinder, 3-hp, 1,500-r.p.m. engine is connected to a 1½-kw., four-pole compound dynamo of 32 volts. A sixteen-cell lead battery furnishes current for the start and during the periods when the set is not running. A pulley on the motor shaft permits direct belt drive. Starting, charging, discharging and stopping are accomplished by push-buttons. The fuel consumption of this gasoline generator is 600 grams per kilowatt-hour. — *Siemens Zeitschrift*, May and June, 1925.

Synchronous Motors Used for Voltage and Power-Factor Regulation.—S. H. MORTENSEN.—With the aid of the well-known characteristic curves the author shows how the motor may be used for the functions indicated in the title, advantageously replacing induction motors in many instances.—*Power*, July 14, 1925.

Contactors for Industrial Motor Control.—W. WILSON.—Many of the recent applications of electric motors to heavy industrial service could scarcely have been made but for the development of electrically operated contactors whereby remote control and automatic response to predetermined conditions have become possible. The author points out important differences between contactors with direct-current and with alternating-current magnets, the current in the latter being influenced by the reluctance of the magnetic circuit and being therefore much greater at the beginning of the stroke, when the gap is large, than at the end. For this reason the variation of pull for comparable sizes is much smaller in the alternating-current than in the direct-current form and the acceleration of movement more rapid. — *World Power*, June, 1925.

Traction

Guadarrama Railway.—F. ECKINGER.—Near Madrid there is a famous mountain resort frequented by large numbers of tourists in summer and winter, and to transport them an electric railway has been built connecting Cercedilla in the valley with Navacerrada, 800 m. high, in the mountains. Over a distance of 13 km. the road has thus an average grade of 6 per cent. One motor car 18 m. long, pulling two trailers, constitutes a train. Direct current of 1,200-volt trolley potential operates four motors in two groups of each two permanently series-connected motors, the total capacity of which is 390 hp. The motor car has one centrally located controller, actuated from either car end by a mechanical transmission gear. To increase the safety on the long down-grade run a pair of pneumatically operated brake shoes, acting directly upon the surface of the rails, is installed on the cars, in addition to the customary wheel brakes and electric motor brakes. The air compressor motor is designed for 1,200 volts direct current. Two arch-type current collectors are mounted on the roof of the cars. The power supply for the road is derived from a Diesel motor-driven three-phase generator and and interposed 350-kw. mercury-arc rectifier set. The latter can carry 100 per cent overload for four minutes, 200 per cent for one minute.—*Brown-Boveri Mitteilungen*, July, 1925.

Spanish Electrification: Ferrocarrils de Cataluna y Sarria.—H. C. HUTCHINSON.—This undertaking, starting with a 600-volt electrification of 3.9 miles in 1906 in the vicinity of Barcelona, now comprises a total of about 25 miles, most of it operated at 1,200 volts. The present article, which is illustrated with maps and views, gives data on rolling stock, overhead system and power equipment. Three-phase, 50-cycle power is supplied from the lines of the Ebro Irrigation and Power Company at 25,000 volts and stepped down at each substation to the 6,000 volts used for the synchronous motor-generators. Operating statistics for 1923 are also given.—*General Electric Review*, July, 1925.

Telegraphy, Telephony, Radio and Signals

Power Amplifiers in Transatlantic Radio-Telephony.—A. A. OSWALD and J. C. SCHELLENG.—This paper, partly descriptive and partly analytical, deals primarily with the development of a 150-kw. radio-frequency amplifier. The characteristics of the single-sideband eliminated-carrier method of transmission are discussed with particular reference to its bearing on the design of the power apparatus. Curves of amplifiers operating under different conditions are given and a classification into three types is proposed, based on the portion of the tube characteristic used. The theory, electrical design and mechanical construction of the last two stages of the amplifier in the system under consideration are outlined, including the output and antenna circuits. It is shown that there is an interrelation between the antenna constants, power requirements and tube replacements which must be considered for the most economical design. Circuit diagrams, photographs and a number of characteristic curves are discussed. In particular the Rocky Point equipment for transatlantic telephony is described. The operating voltage of the tubes is 10,000. The type of tube employed will develop 10 kw. in a suitable oscillating circuit, with a direct current in the anode circuit of 1.4 amp. or less. The grid current is between 0.1 amp. and 0.3 amp., the filament current 41 amp. at 22.5 volts. The grid must usually dissipate 200 watts to 250 watts. The amplification constant is about 38, and the negative potential applied to the grid to reduce the anode current to zero is about 260 volts. The anode, which forms part of the containing envelope, is cooled by being immersed in water kept in continuous circulation.—*Proceedings of the Institute of Radio Engineers*, June, 1925.

Sound Recording.—F. TRENDELENBURG.—To establish the most desirable characteristics of transmitters, amplifiers and receivers, the author investigated the exact nature of the human voice by recording sounds. A condenser microphone, similar to the Riegger type, was found to be best suitable as a transmitter, because it gave the least distortion. The recorder itself was an oscillograph of very high own frequency. This combination gave satisfactory results between 50 and 5,000 cycles. To reproduce sound like the S and F truthfully, apparatus for as high as 8,000 cycles would have to be used. — *Elektrotechnische Zeitschrift*, June 18, 1925.

Miscellaneous

Growth of Industrial Electrification in France.—HUGH QUIGLEY.—This statistical study relates particularly to the coal-mining, iron and steel and electrochemical and electrometallurgical industries, concerning which a profusion of data is presented and analyzed. It deals mainly with national, or at least regional, totals. In addition to figures on installed power-station capacity and energy consumption there is information on production in terms of both tonnage and value, exports and imports and number of employees. The important feature in reconstruction since the war has been the introduction of electricity into every process connected with mning capable of being electrified. Thus in the coal-mining industry there has been a net increase since 1919 of 546,470 kw. of installed power plant, with 239,130 kw. projected. In the electrochemical and electrometallurgical industries the hydraulic plant of the main firms amounts to 400,100 kw., with an estimated total for the whole industry of 630,000 kw.—*World Power*, June, 1925.

The Electrical Engineer in the Merchant Marine.—G. A. PIERCE.—A summary of this paper may be found in the report of the spring convention of the A. I. E. E. in the ELECTRICAL WORLD for April 25, 1925, on page 863. *Journal A. I. E. E.*, July, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Cut-Out, Fusible, Primary, Expulsion Type

Interlocking gas barriers divide the interior of the cut-out into two compartments. This prevents hot conducting gases expelled from the link holder during the blowing of the fuse from short circuiting the terminals and thus causing an arc-over which might result in failure.—*General Electric Company, Schenectady, N. Y.*

Furnace, Electric, for Forging

It is now possible to design a commercial electric forging furnace for operation at 2,400 deg. F. which can be kept in continuous operation without the necessity of shutting down for repairs to the heating elements. Any one of the heating elements can be replaced from the outside of the furnace within five minutes, without lowering the furnace temperature sufficiently to interfere with production.—*American Resistor Company, Milwaukee, Wis.*

Graphic Meter for Recording Disturbances

A small electric motor, mounted on the side of the meter case, is arranged to drive the chart. The chart is normally driven by the clock at the desired hourly chart speed, and the gears between the motor and the chart drive roll are disengaged. When, owing to a disturbance, the relay in the circuit acts, it closes a circuit through an electromagnet installed near the motor, which instantly meshes the gears connecting the motor shaft to the drive roll. The small motor runs continuously, so that the time required to speed up the chart is only that necessary to engage the gears, which is less than one-twenty-fifth of a second. The chart is operated at high speed as long as the relay is closed and the electromagnet energized.—*Esterline Angus Company, Indianapolis, Ind.*

Lubrication, Wool-Yarn System of

A line of small motors has been put on the market which have a lubrication system called the "wool-yarn" system, consisting of a number of continuous strands of wool yarn placed over the shaft and projecting down into the oil in the well. In this system the oil is carried from the well to the shaft by capillary attraction instead of a revolving ring as is the usual practice. The compartment carrying the yarn and oil is practically dustproof. The yarn also acts as a filter for the oil.—*A. I. E. E. Machinery Committee.*

Recording Instruments, Mechanical

Three sensitive instruments have been recently developed—a vibrograph based on the seismograph principle, an accelerometer for motor vehicles and elevators, and a torsion meter. The latter may be connected to an oscillograph for an electric record. For a description of these devices see *Optical Society of America Journal*, 1925, Vol. 10, page 460.—*Cambridge Instrument Company, London S. W., England.*

Recording of Small Movements on Celluloid

Records of very small size are obtained by the action of a moving stylus upon transparent celluloid film. The pressure upon the stylus is extremely small, and the celluloid appears to flow plastically about the rounded point of the stylus. The records can be read by a microscope accurately to 0.01 mm. or can be projected optically, so that considerable optical magnification may be obtained (frequently up to 50 diameters), which, with an initial mechanical amplification of ten times, gives a total magnification of 500 diameters. As small movements can thus be successfully recorded, the moving parts of the instruments can be made very light.—*W. G. Collins, Cambridge Instrument Company, London, S. W., England.*

Telegraph, Printing, for Cables

A printing telegraph system for use on ocean cables has been developed and is in commercial operation on a transatlantic cable circuit between London and New York. In this system, signals sent from a transmitter at London are translated and printed in Roman characters at New York without manual handling at any of the intermediate repeater stations.—*Western Union Telegraph Company, New York, N. Y.*

Varnishes, Tests for

Instruments have been developed for testing hardness, gloss, color and leveling of varnishes. For details see a paper recently presented before the American Society for Testing Materials.—*A. H. Pfund, Johns Hopkins University, Baltimore.*

In Progress or Purposed

Boiler-Feed Water, Scale Formation in

An investigation has been made of the chemical equilibria existing in boiler waters under various conditions; also of the mechanism of scale formation. Judging by the results of the investigations, to inhibit scale formation it is of paramount importance to establish and continuously to maintain in the boiler water definite relations between its metallic and acidic radicals. These relations depend upon the relative concentrations of the radicals in the untreated water, also upon the temperature (or pressure) at which the boiler operates, and are controlled by the regulated addition of a chemical. Fortunately, the conditions maintained for the prevention of scale are those which also retard corrosion.—*National Electric Light Association.*

Candle-Power Standard

The proposed standard device consists of a cylindrical platinum fuse with a longitudinal slit. This is supported by conductors at both ends and heated by an electric current. A certain section of the interior as viewed through the slit has been found to follow the "black-body" law, and readings are taken with increasing temperature up to the point where the platinum melts, blowing the fuse. In other words, the method measures the light emitted by a black body at the melting point of platinum, a condition which has been regarded as most likely to give a suitable primary standard.—*H. E. Ives, Bell Telephone Laboratories, Inc., New York, N. Y.*

Insulating Materials, Molded, Standard Methods of Testing

Experience has shown that the procedure for making the various tests at elevated temperatures was inadequate and permitted a considerable variation in results. It is not practicable in commercial testing to make sufficiently precise tension tests at high temperatures, and as the desired information is, for all practical purposes, given by a transverse test, it is believed that tension tests at elevated temperatures could be omitted. After considerable experimental work and study by a number of laboratories, a more precise procedure has been agreed upon for compression, transverse and dielectric strength tests at elevated temperatures.—*American Society for Testing Materials, Philadelphia.*

Seger Cones, Standardization of

Seger cones are used for estimating temperatures in firing insulators. They are made to soften and to bend at various predetermined temperatures. Work is in progress on standardization of such cones.—*Bureau of Standards, Washington, D. C.*

Turbine Blading, Vibrations of

Study is being given to the question of the natural period of vibration of turbine blading. Experimental results so far obtained show that natural vibration frequencies of certain blade sections at room temperature, if subjected to centrifugal force, check very closely with calculated estimates. The effect of temperature on the modulus of elasticity of blading material is now the subject of an exhaustive study. The effect of centrifugal force may be accurately calculated, so that knowing the dimensions and material of any given row of blading, its natural frequency can be calculated to determine whether or not it is different from the rotating speed of the machine.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Welding of Large Steel Structures

The officers of the bureau have spent a good deal of time in planning a comprehensive investigation looking toward the extension of the use of welding in the fabrication of large structures, such as bridges, cranes, buildings, etc. Preliminary study indicates that welding has enormous possibilities both as regards economy and better product.—*American Bureau of Welding, New York, N. Y.*

Suggestions for Research

Capacitors, Static, Use of Current—Limiting Reactors with

Static condensers (capacitors) are being used more and more across alternating-current lines for power-factor correction. It is desired to investigate the effect of a current-limiting reactor (both with and without an iron core) in series with a set of condensers. Theoretically, such a reactor should smooth out surges due to higher harmonics and limit the fuse current in case of breakdown. However, there may be unexpected practical difficulties and unforeseen secondary phenomena due to a reactor.

Conductors, Overhead, Mechanical Vibrations in

In mechanically highly stressed conductors standing waves and vibrations are sometimes observed which fatigue the strands and cause mechanical failure. It is desired to investigate the probable causes of such vibrations—for example, the wind—and to compute the natural frequency of standing waves for the usual practical conditions. Knowing the phenomenon itself, rational remedies may suggest themselves.

Converters, Synchronous, with Split Poles

The split-pole converter has lately lost its popularity, probably because at the present time there seems to be no simple scheme for properly controlling the excitation of the commutating poles, for changes in the split-pole excitation to give the proper voltage regulation. With this problem solved, the split-pole converter should prove a satisfactory and less expensive machine than one equipped with a synchronous booster.

Synchronous Motor, Self-Starting

There is a considerable field for a synchronous motor which can start as an induction motor under heavy load. The so-called synchronous induction motor requires switching-in of the direct-current excitation at the proper time. A machine in which this change takes place gradually and automatically has been suggested by T. Yamamoto ("Selected Papers" from the *Journal* of the I. E. E. of Japan, 1924, No. 3). He uses a series-connected single-phase exciter in the rotor circuit. This exciter automatically becomes a direct-current exciter at synchronism. The proposed machine has some drawbacks which possibly may be eliminated by further research.

Tie Line, Load Limit of

How much load can be handled over a 100-kv. tie line connecting two large independent systems and carrying equal amounts of power in both directions with dependence placed on tap-changing devices for the maintenance of stabilized voltage in both systems? Can such tap-changing devices be relied upon where the interchange between the systems is to be automatic in accordance with the variations of load and with the conditions of most economic operation in the two systems combined?—*Percy H. Thomas, New York, N. Y.*

News of the Industry

Samuel Insull Utters Warning Note

President of Commonwealth Edison Company Deplores Current Tendency to Sell Utility Stocks on a Speculative Rather Than an Investment Basis

DISTURBED by what he considers the unduly inflated prices at which the stocks of many public utility holding companies are selling on the market, Samuel Insull, president of the Commonwealth Edison Company, Chicago, has by means of a statement published widely in the daily press this week spoken in the interest of prudence and caution. He deplores the current high quotations and recent wide fluctuations in utility securities and believes that such prices and the market practices by which they are realized cannot long endure. In particular he warns small investors not to be tempted by the alluring predictions of the market speculators. Mr. Insull has watched developments in the holding-company investment field with misgiving for some time, but has hitherto withheld comment, fearing that his motive might be misconstrued. He points out that there is little or no speculation in the securities of the local operating companies.

Differ from Industrial Stocks

"There is an absurd tendency to confuse public utilities with industrial corporations," Mr. Insull says. "In the nature of things, utilities cannot earn enough to justify the prices to which many utility stocks have gone. A given number of dollars put into the utility business, with close management, will afford a good return. They never can justify the foolish predictions recently made by those interested in speculation.

"Before the war public utility stocks, especially those in the larger cities, sold on about a 6 per cent basis. I cannot see anything more than that for them for the long pull.

"This business never will show such great returns as suggested by predictions of $25, $30 and $40 a share earnings, even in good times, nor in bad times will it suffer from lack of earnings and reorganization. That is the essential difference between this and the manufacturing business. The best evidence of this stability and moderation is the experience of electric light and power companies and gas companies during the war and the post-war adjustment periods as contrasted with that of manufacturing enterprises.

"I believe the recent price trend of most of our public utility stocks and the manner in which markets have been developed are very detrimental to the business in the long run. I hope utility stocks will be permitted to sell on an investment basis. Occasionally a company with exceptional earnings or one with subscription rights to distribute may expect to see its stock sell above an investment basis, but the proper measure of the worth of a utility stock is its investment worth based on its present probable return."

Middle West Utilities Shares

Mr. Insull's statement is understood to have been immediately prompted by extravagant and irresponsible statements published last week about the Middle West Utilities Company to the effect that the company would earn $40 a share this year and show a net increase of $25 a share on its common stock after deduction of liberal charges. As a matter of fact this company, of which Samuel Insull is chairman of the board and Martin J. Insull president, has prospered greatly and last year earned about $14 a share on its common stock, including the surplus accumulations of many subsidiaries; but Mr. Insull has no idea that the present rate of gain in its earnings can be indefinitely maintained and regards the prediction quoted as absurd.

A sharp reaction in the prices of utility stocks, some of which were sold from nine to seventeen and a half points below the previous day, took place in the New York curb market on Tuesday and was attributed to Mr. Insull's statement.

Buffalo Abandons Gas Lighting for Its Streets

The Buffalo General Electric Company has just received a contract from the city of Buffalo to replace with electric lamps all the existing gas lamps of that municipality. It is probable that Buffalo has more streets still lighted by gas than any other large city in the country. The reason for this is that nearly forty years ago Buffalo entered into a sixty-year contract with the then existing Buffalo Gas Company for the lighting of its streets. This contract was so strictly drawn that as electric lighting of cities developed the city's legal authorities were unable to find a flaw by which it could be attacked. As a consequence, until about three years ago, when the old Buffalo Gas Company became insolvent and was dissolved because its business was reduced almost entirely to street lighting at a low rate, hundreds of miles of Buffalo streets were still lighted by gas under the old contract. Since then, under new contracts with the Buffalo General Electric Company, material progress has been made in replacing gas lamps with electric illumination, but there is still a vast amount to be done.

The new contract runs for two years from the beginning of 1926 with the option of a renewal for another year. Equipment for the business streets will consist of 4-amp. and 6.6-amp. inverted magnetite lamps of the type used in streets where the illuminating system already has been converted. Residential street illumination will be by incandescent lamps of 100 cp. to 150 cp. with underground conduits. These will be of the same type which have already been installed in residential streets by the Buffalo General Electric Company to the number of about 2,000.

Fuel Economy at Lakeside

Equipment for the Low-Temperature Distillation of Coal to Be Installed at Milwaukee

AT THE Lakeside plant of the Milwaukee Electric Railway & Light Company, which was one of the pioneer companies in the burning of pulverized coal, additional equipment designed to insure economy in fuel is to be installed. An agreement has just been signed by the North American Company, owner of the Milwaukee company, by which the International Combustion Engineering Company of New York will install its equipment for the process known as the low-temperature distillation of coal.

Process Not Yet Tried

"This will be the first installation of this invention on the American continent," said S. B. Way, vice-president and general manager of the Electric Railway & Light Company, a few days ago. "It is also likely that it will be the first in the world, although the International Combustion Engineering Company has recently negotiated for the building of a similar plant at Birmingham, England.

"This system of low-temperature distillation of coal has been perfected after more than two years of experimentation at the Lakeside power plant by John Anderson, chief engineer of the Milwaukee company, and the International Combustion company's engineers, headed by Dr. Walter Runge.

"The initial plant to be installed at Lakeside will provide for the treatment of at least 210 tons of coal a day, which is about one-fifth of the plant's present coal requirements. The coal is pulverized before being heat-treated, and the oils, gas and other residuals are recovered under low temperature. This leaves the coke in such form that it can readily be burned in a pulverized-fuel furnace. In fact, it can be burned with certain advantages over the burning of pulverized raw coal.

"This idea could be tested commercially only in a large plant. The experiments show economy in using coal and also economy through the recovery of all manner of fuel oils and of gas, all of which can be separated from the

coal and sold. This plant will provide valuable ways for conserving all the elements that are in raw coal."

Plant engineers all over the world are expected to manifest great interest in the experiment about to be made at the Lakeside plant.

Large Projects Planned for Cowlitz River, Wash.

Four applications to appropriate water and two applications to construct reservoirs on the Cowlitz River in Lewis County, Wash., all for hydro-electric purposes, have been filed recently with the State Supervisor of Hydraulics. The two applications to construct reservoirs and three of the applications to appropriate water were filed by H. W. Crozier, Chehalis. The applications are for units of a fifteen-hundred-thousand-dollar power project, he said. The three water applications are identical in nature and cover three units in a plan for the development of the Cowlitz River, according to Mr. Crozier, these units to be known respectively as Mayfield, Mossy Rock and Big Bend. The dams are to be 135 ft. high, and the total net fall to be utilized is 123 ft. A concrete power house is to be built.

The three plants are to have a total capacity of 54,000 kw. The storage capacity of the two lower plants of the project, Mayfield and Mossy Rock, will be utilized, Mr. Crozier explained, to augment the lack of storage in the Big Bend unit and thereby permit conservation of the maximum power which may be realized between the intake of the Mossy Rock unit just below the confluence of the Cispus River and the discharge of the Mayfield unit at the end of Mayfield Canyon. Both reservoir applications are for the storage of 25,000 acre-ft. of water to be taken from the Cowlitz River. Construction of the reservoirs is to begin about one year after the completion of the power plants proper.

The sixth application, which is for an unspecified amount of water from the Cowlitz River for hydro-electric purposes, was filed by J. G. Kelley, Portland. The project proposes to develop 54,545 hp., according to the application. Construction costs are not given. The diversion dam is to be 80 ft. high and power is to be developed at a fall of 80 ft. A masonry dam and power house are to be built. Mr. Kelley requested that the application be held in abeyance for a reasonable length of time to permit him to make necessary surveys and maps for completing his application.

Water Shortage on Menominee River

Hydro-electric plants operated by public utility and commercial companies on the Menominee River, on the Wisconsin-Michigan boundary, which normally develop from 14,000 hp. to 17,000 hp., are requesting industrial power consumers to curtail the use of power owing to the low headwaters of the river. These are at the lowest stage in its history, causing a serious shortage of power. Service to one large mining consumer who normally uses 2,000 hp. from the Peninsular Power Company was entirely cut off to conserve the supply for other purposes. More than half of the power load is being carried by the power company's coal and oil burning standby plants at Iron River, which are operating at full capacity at a heavy expense. The end of power shortages and unlimited quantities of power to meet all requirements in this district will come, it is predicted, when the North American Company finishes the construction of its steel-tower transmission line from Milwaukee to Iron Mountain.

Associated Gas to Buy Penn Public System

Public Utilities with Aggregate Assets Estimated at $175,000,000 Will Be United by the Transaction—Cash Payment of $20,000,000

OUTSTANDING among public utility sales and mergers this week was the announced coming purchase of the Pennsylvania Electric Corporation, known as the Penn Public System, by the Associated Gas & Electric Company, operated under the management of the J. G. White Management Corporation. By this transaction, which, it is reported, involves a cash payment of $20,000,000, public utility companies with combined assets exceeding $175,000,000 will be brought together. The area served, with a population of 2,000,000, stretches from western New York through Pennsylvania and western Maryland and includes 300,000 consumers in 900 communities of New York, Massachusetts, Connecticut, Vermont, New Hampshire, Maine, Kentucky, Tennessee, Pennsylvania and Maryland. The Associated Gas & Electric also controls the Manila (P.I.) Electric Corporation.

Subsidiary companies of the Pennsylvania Electric Corporation are the Erie (Pa.) Lighting Company, the Penn Public Service Corporation with headquarters at Johnstown, Pa.; the Clarion River Power Company, Foxburg, Pa.; the Venango Public Service Corporation, Johnstown and Union City, Pa., and the Youghiogheny Hydro-Electric Corporation, Oakland, Md. Hydro-electric plants on the Clarion and Youghiogheny Rivers are at present under way.

The power stations of the two companies, including both steam and hydro-electric, have more than 325,000 hp. installed capacity and 2,500 miles of high-tension transmission lines. By increasing the capacity of the larger stations and gradually eliminating the smaller ones it is expected that economies aggregating $1,000,000 will be achieved in the development of electric power.

Laclede Gas Light Company Denies Merger Story

Widely published newspaper reports to the effect that control of the Laclede Gas Light Company of St. Louis, which does an electric light and power business, was to pass to the American Light & Traction Company and that both companies would then be taken over by the United Light & Power Company—a merger capitalized at $170,000,000 being thus brought about—were emphatically denied the other day by C. A. Munroe, chairman of the board of directors of the Laclede Gas Light Company, who said: "You are authorized to quote me as denying that any merger of the Laclede Gas Light Company or the Laclede Gas & Electric Company is contemplated or is being negotiated." Frank T. Hulswit, president of the United company, also entered a strong denial of the rumor.

The Laclede Gas & Electric Company, an Eastern holding company, acquired control of the Laclede Gas Light Company about a year ago. The assets of the Laclede company are given as $64,553,520. The United Light & Power Company, a Maryland corporation, was formed in 1924 to succeed the United Light & Railways Company. It controls public utilities in ninety-seven cities.

Navigators Cause Water Storage at Muscle Shoals to Stop

Impounding of water at the Muscle Shoals Dam was discontinued August 10 so that the full flow of the Tennessee River may be available for navigation. The stage of the Tennessee is lower than at any other time on record. Navigation of that stream is seasonal and no great loss results from its interruption, but vigorous complaints have been registered by those concerned with navigation on the Mississippi River, who think that the diversion at Muscle Shoals is partly responsible for low water. General Edgar Jadwin, the acting Chief of Engineers, is convinced that any water which has been used to build up the pool at the Wilson Dam has not affected navigation appreciably in the Mississippi, but to prevent any feeling that this is responsible for the difficulties now being experienced, he will withdraw no further water until higher stages are available.

Loss of revenue from the sale of the power alone approximates $1,000 per day. It also is of great importance to the Southeastern States to make this power available at the earliest possible date. The demand for power in that area never has been so great. The Alabama Power Company, for instance, sold more power in June than in any other month of its history. Because of the dry season 82 per cent of the June output was developed at steam plants. Every reserve plant in its system has been called into service. The steam plant which that company is leasing from the government at Muscle Shoals has been operated at capacity for nearly two months.

The pool at Muscle Shoals still lacks 12 ft. of being at the operating level.

New Brunswick Government Badly Defeated

The Liberal government of the Canadian Province of New Brunswick, which had championed a policy of governmental development of hydro-electric power at Grand Falls on the St. John River, was badly defeated by the Conservative party in general elections held on Monday of this week and will have only a small minority in the new Parliament. Premier Venoit's proposed expenditure of $10,000,000 on the water-power project is asserted to have played a large part in compassing his defeat. As a result of the elections there will probably be considerable oelay in the development at Grand Falls. J. B. M. Baxter, the new Premier, who has repeatedly stated that if elected to office he would annul any contracts already let for the work, said after the election: "While I will not be taking any steps for two or three weeks, the whole work will be investigated and the present contracts will not be proceeded with."

A. I. E. E. Appointments

President Pupin Announces Names of Members Who Will Head the Standing Committees

AT THE first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning August 1, 1925, held in New York on Thursday, August 6, President Pupin announced the committee appointments for the administrative year commencing August 1, 1925. The chairmen of the committees appointed are as follows:

GENERAL COMMITTEES

Board of Examiners.—Erich Hausmann, Brooklyn, N. Y.
Finance.—G. L. Knight, Brooklyn, N. Y.
Sections.—Harold B. Smith, Worcester, Mass.
Meetings and Papers.—E. B. Meyer, Newark.
Publication.—L. F. Morehouse, New York.
Co-ordination of Institute Activities.—Farley Osgood, Newark.
Student Branches.—C. E. Magnusson, Seattle.
Membership.—J. L. Woodress, St. Louis.
Headquarters.—H. A. Kidder, New York.
Law.—W. I. Slichter, New York.
Public Policy.—Gano Dunn, New York.
Code of Principles of Professional Conduct.—John W. Lieb, New York.
Safety Codes.—Paul Spencer, Philadelphia.
Standards.—H. S. Osborne, New York.
Edison Medal.—Gano Dunn, New York.
Institute Prizes.—L. W. W. Morrow, New York.
Columbia University Scholarships.—W. I. Slichter, New York.
Licensing of Engineers.—Francis Blossom, New York.

TECHNICAL COMMITTEES

Electrical Machinery.—H. M. Hobart, Schenectady, N. Y.
Power Generation.—V. E. Alden, Baltimore.
Power Transmission and Distribution.—Percy H. Thomas, New York.
General Power Applications.—A. M. MacCutcheon, Cleveland.
Applications to Marine Work.—L. C. Brooks, Quincy, Mass.
Applications to Mining Work.—F. L. Stone, Schenectady, N. Y.
Applications to Iron and Steel Production.—F. B. Crosby, Worcester, Mass.
Electrochemistry and Electrometallurgy.—G. W. Vinal, Washington, D. C.
Production and Application of Light.—P. S. Millar, New York.
Communication.—H. P. Charlesworth, New York.
Instruments and Measurements.—A. E. Knowlton, New Haven.
Protective Devices.—E. C. Stone, Pittsburgh.
Electrophysics.—J. H. Morecroft, New York.
Education.—Harold Pender, Philadelphia.
Research.—J. B. Whitehead, Baltimore.

The board of directors confirmed the appointment by President Pupin of new members of the Edison medal committee for terms of five years each as follows: George Gibbs, New York; Samuel Insull, Chicago; R. D. Mershon, New York. The board also elected three of its membership as members of the Edison medal committee for terms of two years each, namely: W. P. Dobson, Toronto; Farley Osgood, Newark, and A. G. Pierce, Cleveland.

Power Officials Approve Ohio License, Consider Yuba

Favorable action by the Federal Power Commission on the application by the Louisville Hydro-Electric Company for a license to build a plant on the Ohio River at government dam No. 41 is recommended in a report submitted by the Chief of Engineers. He suggests that a portion of the cost of raising the dam be covered by an amortization charge to be included in the annual payments which will be made by the licensee. This amount will include the additional cost of maintenance and of the operation of the navigation structure. It is probable that an annual charge of $100,000 for the use of the government's property will be assessed.

In view of new data submitted by the Nevada Irrigation District in connection with its application for power rights on the Yuba River, the staff of the Federal Power Commission is reconsidering the matter. The executive secretary of the commission on June 6 tentatively rejected the application of the irrigation district, but with the proviso that consideration would be given additional information bearing on the project and calling attention to the right of the applicant to carry the case before the three Cabinet officers who form the commission. The irrigation district has decided to avail itself of that suggestion in case the staff of the commission on reconsideration should report unfavorably. The commission's engineers questioned some of the estimates which had been made on construction work. The irrigation district now presents actual bids to substantiate its figures as to the cost of structures.

The application of the irrigation district is in conflict with those of the Yuba River Power Company and the Excelsior Power & Water Company. The application of the Excelsior company also was rejected and the Yuba River company was asked to establish its state rights.

The New River Development Company has advised the Federal Power Commission of its intention of undertaking a development on New River near Hiwassee, Va. The development would affect the river from Hiwassee to a point near the mouth of Little River, 20 miles distant. It is proposed to install four units of 15,000 kw. each.

Hoover to Speak at Glenwood Springs, Col.

Secretary of Commerce Hoover has accepted an invitation to be the principal speaker at the annual joint convention of the Rocky Mountain Division, N. E. L. A., and Colorado Public Service Association at Glenwood Springs, Col., September 14-17. "State Versus Federal Regulation" will be the subject of Mr. Hoover's address on Wednesday night, September 16, and arrangements have been completed for broadcasting it from the General Electric station in Denver.

Other speakers of national importance in N. E. L. A. circles who will appear on the program are M. H. Aylesworth, W. R. Putnam and Miss R. E. McKee. Merle Thorpe, editor of *The Nation's Business;* Chancellor Heber R. Harper of the University of Denver and L. Ward Bannister, president of the Denver Chamber of Commerce, are also listed to address the convention.

N. E. L. A. Chairmen

Committees Are Rapidly Being Filled—Sloan Will Remain in Charge of Public Relations

HEADQUARTERS of the National Electric Light Association, under the direction of President James E. Davidson, is hard at work on committee appointments for the current year. So far the name of only one national section chairman has been announced—that of M. S. Sloan of Brooklyn, who will continue as head of the Public Relations Section, which he directed in the association year just finished. Others who had accepted chairmanships up to the time that the ELECTRICAL WORLD closed its forms are as follows:

SPECIAL NATIONAL COMMITTEES

Charles A. Coffin Prize.—J. E. Davidson, Omaha.
Constitution and Bylaws.—W. C. L. Eglin, Philadelphia.
Electrical Resources of the Nation.—C. E. Groesbeck, New York.
Electrification of Steam Railroads.—John W. Lieb, New York.
Finance.—J. B. McCall, Philadelphia.
Lamps.—Frank W. Smith, New York.
Prize Awards.—W. H. Onken, Jr., New York.
Public Policy.—Martin J. Insull, Chicago.
Rate Research.—Edwin Gruhl, New York.

GENERAL NATIONAL COMMITTEES

Educational.—Fred R. Jenkins, Chicago.
Insurance.—G. H. Bourne, New York.

ACCOUNTING NATIONAL SECTION

Classification of Accounts.—W. J. Meyers, New York.
Editing.—W. C. Lang, New York.
Fixed Capital.—E. S. Haymond, Pittsburgh.
General.—W. B. S. Winans, New York.
Purchasing and Storeroom.—E. S. Brock, Newark.
Revenue and Disbursements.—J. F. Ford, Philadelphia.
Statistical Methods.—L. S. Goodman, Boston.

TECHNICAL NATIONAL SECTION

Accident Prevention.—Charles B. Scott, Chicago.
Electrical Apparatus.—E. C. Stone, Pittsburgh.
Hydraulic Power.—R. L. Thomas, Baltimore.
Inductive Co-ordination—Howard S. Phelps, Philadelphia.
Meters.—A. G. Turnbull, Chicago.
Overhead Systems.—H. C. Sutton Philadelphia.
Prime Movers.—A. D. Bailey, Chicago.
Underground Systems.—C. H. Shaw, New York.

Shortage of Power in Ontario

Annual Report of Hydro-Electric Power Commission Points to Development on St. Lawrence as the Way of Escape—Rural Power Rates Revised

THE menace of a pending shortage of power is one of the principal facts stressed in the annual report of the Ontario Hydro-Electric Power Commission, issued very recently.

Attention is drawn to the fact that the commission has completed a most successful year, being able once again to report that the revenue obtained from consumers has been more than sufficient to meet the full cost of generating and transmitting electrical energy as well as to provide for all operating expenses and the fixed charges of the municipal utility equipments. The report shows that, after meeting all these charges, the commission has a net surplus on the year's operations of $725,708.

In spite of the general industrial depression, there has been a considerable growth in the demand for power on nearly all systems, and on several systems the commission has reached the limit of the capacity of the existing generating plants.

With reference to the possibilities of a power shortage, the report says: "During the past year special efforts have been made by the provincial government, the municipalities and the Hydro-Electric Power Commission to secure permission to commence construction of the power development works in the international portion of the St. Lawrence River. Delay in securing the permission sought must result in accentuating the power shortage that is rapidly materializing."

The commission supplied more than 3,000,000,000 kw.-hr. of electrical energy during the year ended October 31, 1924. Referring to the increased demand which is expected with a return to better business conditions, the report says: "The full capacity of the commission's generating plants is not sufficient to provide for any abnormal increase in the demand for power, such as may follow an industrial revival, and is even inadequate to meet the needs of power consumers during a year of normal growth. Further sources of power must be provided during the coming year if restrictions on the supply to consumers are to be avoided."

RURAL RATES REVISED

Announcement is made of a revision of rates in the rural power districts now being served by the commission. The commission has contracts with 146 townships, situated in various parts of the province, 138 of which are now being served as part of ninety rural power districts. The report states that, "based on its experience in the operating of rural power districts, the commission has found it necessary in many of these districts to adjust the service charge and consumption rates, in order that the service supplied to the consumers may be as nearly as possible on a cost basis. In sixty-five of the rural power districts served it has been found necessary to make a reduction of from 5 to 40 per cent in the service charge, and in fifty-seven of the rural power districts a reduction of from 5 to 25 per cent in the consumption charges. The remaining twenty-five rural power districts now being supplied have only been operating for short periods, and no rate adjustment there can be made until the operating conditions become more stable.

"The commission has already expended about $2,700,000 to supply service to some 10,800 rural consumers, in addition to the consumers served by municipalities in suburban areas. Approximately 1,400 miles of transmission line has been constructed to supply these customers with service."

During the period under review the commission collected from the municipal utilities and other customers for power sold a total sum of $16,897,866. This sum was appropriated to meet all the necessary fixed charges and to provide for the expenses of operation and administration. Of the amount collected from the municipalities—that is, the municipalities operating under cost contracts with the commission—the sum of $13,078,003 was appropriated for operation, maintenance, administration, interest and other current expenses, while the sum of $3,094,195 was appropriated as reserves for sinking fund, renewal of plant and equipment and contingencies.

United Light & Power Takes Over Five Ohio Plants

The Ohio Utilities Company's electric light and power plants at Circleville, Delaware, Hillsboro and Gallipolis, Ohio, and the plant of the Chillicothe Electric Railroad, Light & Power Company, controlled by the Ohio & Western Utilities Company, an allied company, have been purchased by the United Light & Power Company, which some months ago came into control of the Columbus Railway, Power & Light Company. The Ohio Utilities Company will continue to operate the plants. Charles S. Slater, general manager of the Columbus Railway, Power & Light Company, has been named a director.

Acquisition of the five distributing companies named indicates that the new Scioto power station of the Columbus company, now under construction 8 miles south of that city, will be the central distributing station for a large high-tension distribution system extending to various sections of Ohio. Cyrus K. Eaton, president of the Columbus Railway, Power & Light Company, in confirming the transfer of ownership, asserted that it was the desire of his company to build up a power load for the Scioto station that will take its full capacity to maintain. When asked whether the United Light & Power Company eventually would extend its interests into other cities in Ohio, Mr. Eaton replied that such an expansion was probable. Columbus may thus in the future become the center of an extensive light and power system.

Although the reported purchase price of the Circleville and Chillicothe plants was $300,000, Mr. Eaton would give no figures on the cost of these or of the plants at Delaware, Hillsboro and Gallipolis.

Midland Utilities Will Control Indiana Service Corporation

The Midland Utilities Company has just taken over control of the Indiana Service Corporation, which has its headquarters in Fort Wayne, Ind. This new subsidiary of the Midland company supplies electric light and power and street-railway service in Fort Wayne and operates three electric railroad lines radiating from that city. It also supplies electric light and power service to twenty-two smaller communities in the Wabash Valley through central Indiana and operates local street-railway systems in Wabash, Peru and Logansport as well as in Fort Wayne. The company operates an electric generating station in Fort Wayne with a capacity of 31,000 kw. It has 150 miles of electric transmission lines and over 1,200 miles of electric distribution lines. The new acquisition closes a gap in the Great Lakes holdings of the Insull interests.

Virginian Water Power

Plan to Interconnect Sites on James and Appomattox Rivers and at Roanoke Rapids

MUCH interest is manifested in Virginia and North Carolina in reported plans of hydro-electric power development by Stone & Webster, who recently gained control of the Virginia Railway & Power Company and of some smaller power companies in North Carolina, notably, the Roanoke Rapids Power Company.

Plans, it is announced, are under way for the eventual construction of a hydro-electric system which will develop the water power of the James River, of the Appomattox at Petersburg, and also at Roanoke Rapids, these sites to be connected by a 110,000-volt transmission line. The plans, when carried out, will make the Virginia Railway & Power Company one of the largest in the South.

The program when completed will provide a transmission system from Richmond to North Carolina, and, through the company's holdings at Roanoke Rapids, well into the last-named state. It would then be possible, with the construction of a comparatively short high-voltage line, to link up the system with either the Carolina Power & Light Company system at Raleigh or the Southern Power Company system at Durham, adding another link to the interconnected system of the South. Estimates of the cost emanating from sources outside the company put it at around $12,000,000.

J. H. Manning, general manager of the engineering division of Stone & Webster, has gone to Richmond to make a personal survey of the territory to be included in the development project. Referring to his mission, Luke C.

Bradley, president of the Virginia Railway & Power Company, issued the following statement to the press:

"Plans are now under way for making a comprehensive study and survey of the available water powers on the James River, on the Appomattox at Petersburg and at Roanoke Rapids, N. C., for hydro-electric development. A force of hydraulic engineers will be organized immediately to investigate all of the details in connection with the project. The program is an extensive one and no approximate estimate can be made at this time as to the cost. The engineers will determine the various steps in this larger development so that the work done from time to time will properly merge into the bigger scheme."

Iron and Steel Men Ready for Philadelphia Meeting

The program which has been planned for the annual convention of the Association of Iron and Steel Electrical Engineers, to be held at the Benjamin Franklin Hotel, Philadelphia, September 14-19, promises a profitable and successful meeting. Oil circuit breakers in connection with high-tension switching will be one of the subjects to come before the convention, and others will be frog-leg armature windings, the report of the electric heating committee, entitled "From the Ingot to the Finished Material"; auxiliaries and auxiliary drives for steam electric generating stations, and the extension of the heat cycle in boiler operation by the use of preheated air combustion. The annual banquet will be held on Thursday evening, September 17.

Albert Emanuel Interests to Buy Penn Central

Announcement is made by J. H. Shearer, vice-president Penn Central Light & Power Company of Altoona, Pa., that, subject to the approval of the stockholders and the Pennsylvania Public Service Commission, the company, which has been under the management of Day & Zimmermann of Philadelphia, will be sold to the Albert Emanuel interests of New York, which control the National Electric Power Company and operate utilities in twelve states—Ohio, Oklahoma, Arkansas, Kansas, Indiana, South Dakota, Nebraska, Maine, Michigan, West Virginia, Pennsylvania and Kentucky.

The Penn Central operates in a central Pennsylvania district embracing about 4,000 square miles and including Blair, Cambria, Huntingdon and Mifflin Counties and part of Indiana, Bedford, Franklin and Juniata Counties. Among the important communities served are Altoona, Huntingdon and Lewistown. It has property and security valuation exceeding $22,000,000. It owns the Lewistown & Reedsville Electric Railway.

The Penn Central Light & Power Company will retain its present identity and name and will be operated as in the past as a separate company. Mr. Shearer said that no change would be made in the policy of the company in dealing with its patrons and the public.

Building a Switching Station in a Day

How the Detroit Edison Company Worked on Fourth of July to Restore Service Disorganized by a Stroke of Lightning Early the Previous Evening

THE Detroit Edison Company has five hydro-electric plants on the Huron River near Ann Arbor, Mich. The key plant is at Superior, where switching connections are centered and there is a step-down outdoor substation fed by a 120,000-volt line connected with the generating stations at Trenton Channel and Marysville. When at 7 p.m. on July 3 lightning struck a 23,000-volt line leading from Superior to Ypsilanti, making a direct hit near the Superior plant, naturally trouble ensued.

The automatic switch opened, but it failed to break the arc, and the resulting explosion blew out the brick walls of the switch house as much as 16 in. in some places, completely destroyed the windows and doors and broke concrete bus structures and baffles. Solid copper bus connections and fused porcelain were melted, other switches in the switch house tripped out automatically and the station was dead. The burning switch oil sent out clouds of dense black smoke, and the Ypsilanti firemen were called to extinguish lurking flames. Light and power service in the cities of Ann Arbor and Ypsilanti and in half a dozen adjacent villages was completely stopped.

How service was restored in twenty-six hours despite the fact that the next day was Saturday and the Fourth of July is told in interesting detail in the number of the *Detroit Edison Synchroscope* just issued. First, under the direction of Superintendent George Lewis, hydro-electric plants at Barton and Argo were loaded to full capacity and were able to take care of part of the Ann Arbor demand. Next energy was supplied to Argo through a transmission line in the vicinity, enabling service to be restored to the towns north and west of Ann Arbor and to the rest of Ann Arbor itself, which is fed from a substation at Hoover. The work of restoring service began almost immediately after the explosion, and it took only eleven minutes to resume operation in the north half of Ann Arbor and thirty minutes in the remainder of the city.

Ypsilanti presented a harder task. A paper-mill hydro plant there, where the exciter is electrically driven, was thrown out of commission by the accident, and the fifth hydro plant—at Geddes—was involved in the line trouble. The emergency was met by connecting a line running from Superior to Wayne with the north line from Superior to Ypsilanti by means of jumpers, and service was thus restored two hours and thirteen minutes after the accident. Forty-two minutes sufficed for Saline, Milan and smaller places in the territory affected.

Rapid Construction Work

Meanwhile linemen had cut the damaged plant at Superior clear from overhead connections, and the four lines centered at this point were connected solidly together and to the 23,000-volt terminals of the step-down transformer station on the 120,000-volt tower line. This provided plenty of energy, but was obviously a mere expedient, involving possibilities of further trouble, and it was decided to go ahead immediately with the erection of a temporary outdoor wooden-pole switching station to replace the Superior switch house.

The scheme was a bold one. Night had fallen and the work had to be carried on by the light of truck headlights and lanterns. The men had already put in a full day's work and a couple of hours of emergency overtime; it was not certain that the necessary material and equipment were available, and in any event it would have to be trucked out from Detroit, 40 miles away; besides, the following two days would be holidays, with supply houses closed and workmen off duty; there were no engineering plans and blueprints to work from, and the design of the station would have to be a matter of cut and try. Notwithstanding these difficulties, work on a new temporary station was begun in a little more than two hours from the time the lightning struck the plant.

Work Rushed All Night

All through the night of July 3 sixty linemen worked unceasingly. In addition to other difficulties in setting the poles, buried masonry had to be clipped away. By morning twenty-one poles had been set and backfilled, the overhead framing was in place, pins and insulators had been set in the framing and the copper bus wires and connections run. The first truck load of oil switches arrived about 11 a. m., the last at 5 p. m. Direct current for the automatic, solenoid-operated oil switches was obtained from the storage battery in use in the 120,000-volt outdoor substation, over a special lead-covered cable. A control panel for the switch operation was improvised from one taken from the Superior plant, and it was erected at the north end of the new structure, temporarily sheltered with canvas on a wooden frame until such time as a protecting shanty could be built.

The station as finally completed consisted of one switch between the 23,000-volt side of the 120,000-volt substation and the new substation, one section switch between the two buses of the new station and five line switches, all operated from the control panel at the north end.

The connection and testing of the oil switches, the filling of the tanks with oil and the last adjustments were finally completed, and at 9:38 p.m. on Saturday, July 4, Operator Campbell of Superior reported to the system operator at Detroit that a new 23,000-volt outdoor switching station had been built and was ready to go into commission, replacing the switch house of the Superior power plant destroyed by a stroke of lightning twenty-six hours previously.

Briefer News

Vermont Electrical Association to Hold Summer Outing.—Newport, Vt., on Lake Memphremagog, will be the scene of the summer outing of the Vermont Electrical Association, to be held on September 11. The program includes a boat ride and a dinner on the Canadian shore.

Oklahoma's City's Big Electric Sign.—A huge electric sign, said to be the largest in the state, has been erected on the Braniff Building in Oklahoma City. The sign is for a local mortgage company. It is 50 ft. long and 35 ft. high. Its top letters are 6 ft. high and can be read at a distance of 5 miles at night, the contractors say. Approximately 1,500 electric light bulbs will provide the illumination, which will be visible for 15 miles.

Wood River Power Company Purchased by Consumers' Public Service.—The Wood River Power Company, which serves Hailey, Idaho, and several smaller towns near by, has been purchased by the Consumers' Public Service Corporation of Delaware at a price said to have been between $400,000 and $500,000. E. W. Rising of Hailey will be president of both companies, succeeding I. E. Rockwell as president of the local company.

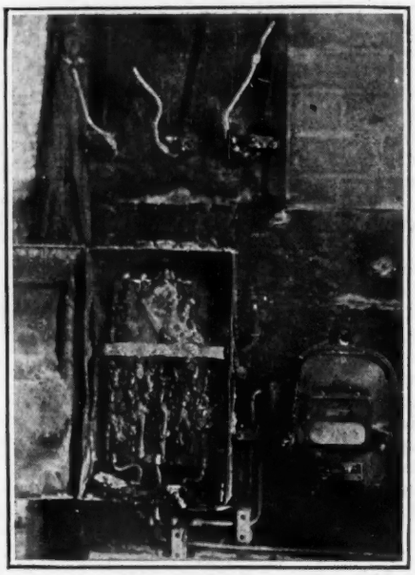
Developing the Muskosh River in Ontario.—Work has been started on the construction of a five-hundred-thousand-dollar storage and power dam on the Muskosh River in the Muskoka district of the Province of Ontario. The work is designed to control the flow from the Muskoka Lakes basin and will make it possible to link up power development in that district with the Eugenia-Severn system of the Ontario Hydro-Electric Power Commission.

West Bend (Wis.) Plant Sold.—The West Bend (Wis.) Heating & Lighting Company, which has been producing and distributing energy for local use and in the towns of Fredonia, Newburg, Random Lake and Saukville, has been taken over by the Central Public Service Company, Chicago. The properties comprise a water-power plant with standby equipment, transmission and local distribution systems. The financial consideration was not made public, but in 1923 the properties of this company were assessed at $196,222.

Richmond (Ind.) Municipal Plant Reduces Rates. — The Richmond (Ind.) municipal electric lighting and power plant, which has twice reduced rates in the last year and in addition has accumulated net profits sufficient to pay off the plant's entire bonded indebtedness next November, two years before the bonds mature, has announced further reductions in all rates. Energy for lighting will range from 6 cents per kilowatt-hour down to 2¾ cents for large users. Power rates will range from 3½ cents down to 1¼ cents for large consumers. The reductions are equivalent to 10 per cent on lighting and 13 per cent on power.

Seventy Thousand Dollars Raised for Experimental Dam. — The fund being raised by the Engineering Foundation to erect an arch dam which can be tested to destruction has now reached more than $70,000. European engineers are aiding in raising the funds. This experimental dam will be built on Stevenson Creek, a tributary of the San Joaquin River, about 60 miles east of Fresno, Cal., and will be 100 ft. high. Tests will be made at the dam at various stages of construction, and it will also be used for engineering experiments and observations. Power companies and governmental authorities, municipal, state and national, are cooperating in the experiment, which is in the hands of civil engineers. The work of placing concrete masonry will probably begin in October. It is planned to build first to 60 ft. and then by 10-ft. stages to the final height.

The Price of Cheap Work.—The accompanying illustration of a 600-volt service installation shows what happens



to many safety devices when placed in service and operated by the average helper or handy man. In this particular case, which was a recent occurrence in a New England plant, the fuses had blown and were replaced by a copper jumper which evidently loosened from the clips and short-circuited the phases.

St. Louis Firms Take Rate Case to United States Supreme Court. — On writs of error a number of large business concerns of St. Louis have appealed to the United States Supreme Court from a recent ruling of the Missouri Supreme Court in favor of the Union Electric Light & Power Company in a controversy concerning rates for light, heat and power. The concerns operated private heating and power plants which were taken over and operated by the Union company. Later the Missouri Public Service Commission set aside the private contracts entered into when the plants were taken over and granted the power company permission to increase rates. The Supreme Court sustained the Public Service Commission. The cases in various phases have been in the courts for several years, and approximately $700,000 is held in escrow, being the excess of the new rates over the old, pending the final outcome of the litigation. In the petitions the federal questions raised include impairment of contract obligations and validity of the law under which the Missouri Public Service Commission was created.

Associated Gas & Electric Acquires Litchfield (Conn.) Plant.—A recent addition to the group of light and power properties controlled by the Associated Gas & Electric Company of New York along the New York State-Connecticut border is the Litchfield Electric Light & Power Company, distributing electricity in Litchfield, Bantam, Morris and Washington in Connecticut. The company has both steam and hydro-electric equipment and also purchases power.

Expansion at Phoenix, Ariz.—Money to be used in the construction of the first of two 10,000-hp. hydro-electric units at the Mormon Flat Dam on Salt River will be advanced to the Salt River Valley Water Users' Association by the Central Arizona Light & Power Company of Phoenix. Under the contract the loan of $410,000 is to carry an interest rate of 6 per cent and is to be entirely refunded in twenty-five years. It is expected to have the new unit in operation in the spring of 1926. The output from this new plant is to be sold at 8½ mills per kilowatt-hour to the Central Arizona Light & Power Company, which contemplates spending approximately $200,000 in the city of Phoenix to handle the distribution of this additional energy.

State Municipal League of Utah Hears Defense of Private Ownership.—P. M. Parry, commercial manager of the Utah Power & Light Company, was one of the principal speakers at the annual convention of the Utah State Municipal League, held at Mount Pleasant recently. The membership of this league comprises city officials of the various cities in the state, and its object is to develop the utmost efficiency in the handling of municipal affairs. "Rate Making for Electric Service" was the subject of Mr. Parry's talk. He explained some of the factors that enter into the making of rates, discussing also outstanding facts of interest in connection with his company's operations during the past twelve years. Mr. Parry also introduced a number of arguments in support of private ownership of public utilities.

Lamp and Wire Inspectors Convene.—The week of August 3 to 8 saw the annual convention of the lamp, wire and cable inspectors of the Electrical Testing Laboratories in New York, it being the eighteenth annual meeting of the lamp inspectors for the Association of Edison Illuminating Companies and the sixth annual convention of those for "Mazda" service. The occasion marked the second annual gathering of the wire and cable men. The various classes of inspectors held many sessions separately in which they discussed their own individual problems. Among the features of the week was an ad-

dress by John W. Lieb, president of Electrical Testing Laboratories, vice-president of the New York Edison Company and chairman of the lamp committee of the Association of Edison Illuminating Companies. On Wednesday the laboratories closed for the day and the entire personnel, with wives and guests, enjoyed an excursion by boat to Indian Point on the Hudson.

Bainbridge (Ga.) Power Company Sold.—The Bainbridge Power Company of Georgia has been bought for $500,000 by John B. Weakley and Eugene Fies, president and vice-president respectively of the Alabama Water Company of Birmingham and the New York banking firm of Brandon, Gordon & Waddell. Mr. Weakley and Mr. Fies will hold the same positions in the new corporation they now hold in the Alabama company. The Bainbridge company serves the town of that name, Donaldsonville, Iron City, Brinson, West Bainbridge and Reynoldsville, all in southwest Georgia.

Phœnixville Mill to Electrify Plant.—After more than one hundred years of continued production by hand, water and steam power successively, the Phœnix Iron Company at Phœnixville, Pa., very soon will have changed fully to electrical operation. A contract for equipment necessary for the electrification of the 36-in. bloomer mill has been awarded to the Westinghouse Electric & Manufacturing Company at a price in excess of $250,000. When installed this will represent 100 per cent electrification of the mill drive and 90 per cent electrification of the steel plant as a whole.

More Iowa Plants Change Hands.—The Northwestern Light & Power Company has purchased the interest of L. R. Schlicter in the Roush & Schlicter Electric Light Company, J. C. Roush has announced. Mr. Roush and Mr. Schlicter recently bought a number of electric light plants in and around Sioux City, Iowa, and Mr. Roush will remain with the company. The company will furnish electric light and power to Bronson, Lawton and Correctionville, where it purchased power plants recently, and is negotiating for the purchase of the Moville electric light plant. A franchise for a high-tension line extending from Correctionville to Moville, Lawton and Bronson has been obtained and permission to build another high-tension line is sought.

Chrysler Motor Corporation Buys Power at New Castle, Ind. — The Chrysler Motor Car Corporation has signed a contract with the Interstate Public Service Company for 1,500 hp. to be used in its motor-car factories at New Castle, Ind. To serve this new load the Interstate company is spending approximately $150,000 in building a substation at New Castle and a 66,000-volt line to connect with the transmission system of the Indiana Electric Corporation near Knightstown, Ind. Power for New Castle and vicinity may then be delivered from the generating plant of the Indiana Electric Corporation at Dresser, near Terre Haute. A 33,000-volt transmission line is now in operation between New Castle and Connersville, Ind., where it connects with a power source in Ohio. A two-circuit automatic substation will be built at New Castle.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

International Association of Municipal Electricians—Hotel Statler, Detroit, Aug. 17-20. W. R. Arbuckle, Bayonne, N. J.

Wisconsin Utilities Association, Electric Section—Green Bay, Wis., Sept. 4-5. J. N. Canby, 445 Washington Bldg., Madison, Wis.

Camp Co-operation V (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 8-12. (Society for Electrical Development, New York, is sponsor.)

New England Division, N. E. L. A.—Hotel Griswold, New London, Conn., Sept. 8-11. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 9-12. Harold A. Buch, 212 Locust St., Harrisburg, Pa.

Pennsylvania State Association of Electrical Contractors and Dealers—Hotel Jermyn, Scranton, Sept. 10. M. G. Sellers, 1202 Locust St., Philadelphia.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 14-17. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers—Benjamin Franklin Hotel, Philadelphia, Sept. 14-19. John F. Kelly, Empire Bldg., Pittsburgh.

American Institute of Electrical Engineers, Pacific Coast Section—Olympic Hotel, Seattle, Sept. 15-18. F. L. Hutchinson, 33 West 39th St., New York.

Great Lakes Geographic Division, N. E. L. A.—French Lick Springs, Ind., Sept. 23-26. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden, Ind., Sept. 23-25. L. W. Davis, 15 West 37th St., New York.

American Electrochemical Society—Chattanooga, Tenn., Sept. 24-26. Colin G. Fink, Columbia University, New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 1-2. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 5-9. J. W. Welsh, 292 Madison Ave., New York.

National Association of Railroad and Utilities Commissioners — Washington, D. C., Oct. 13-16. J. B. Walker, 270 Madison Ave., New York.

Electric Power Club—Briarcliff Manor, N. Y., Oct. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Association of Edison Electric Illuminating Companies — Hot Springs, Ark., Oct. 19-23. Preston S. Millar, 80th St. and East End Ave., New York.

Association of Railway Electrical Engineers—Hotel Sherman, Chicago, Oct. 20-24. J. A. Andreucetti, 413 C. & N. W. Terminal Station, Chicago.

American Welding Society—Boston, Oct. 21-23. M. M. Kelly, 29 West 39th St., New York.

Kansas Public Service Association—Topeka, Oct. 23-24. H. Lee Jones, Topeka, Kan.

Iowa State Association of Electrical Contractors and Dealers—Waterloo, Iowa, Oct. 27.

Southeastern Geographic Division, N. E. L. A.—Chattanooga, Tenn., Oct. 29-30. E. T. O'Connell, Alabama Power Co., Birmingham.

Eastern Texas Electric Company Acquires Western Public Service.—A controlling interest in the Western Public Service Company, operating in cities and towns in Wyoming, Colorado, Nebraska, Missouri, Iowa and Texas, with twenty-three central stations, has just been bought by the Eastern Texas Electric Company, operating in Beaumont and Port Arthur, Tex., and Lake Charles and Jennings, La., under the management of Stone & Webster. It is understood that E. C. van Diest, president and organizer of the Western Public Service, received more than $1,000,000 for the majority stock. All the directors and officers of the old company have resigned and the Colorado Springs headquarters will be closed.

Fayetteville (Tenn.) Municipal Plant Sold to Southern Cities Power Company.—The Southern Cities Power Company has bought the Fayetteville (Tenn.) hydro-electric plant on the Elk River for $435,000 and will supply the town hereafter with electricity. Walter Bunn, manager of the plant, who has been with the plant since it was started thirty years ago, will be manager.

Three Southeastern Municipal Plants Give Up.—The Ware County Light & Power Company of Waycross, Ga., has just purchased the electric distribution system of the city of Blackshear, Ga., and is busy with the construction of a wooden-pole 23,000-volt transmission line, 10 miles in length, from Waycross to Blackshear. The line will at present operate at only 11,000 volts. The present plant at Blackshear will be used as an auxiliary steam plant. The Blackshear plant is the third municipal installation to be acquired by private interests in Georgia in the past few weeks, the other plants being those at Madison, Fla., and at Meigs, Ga.

Valdosta (Ga.) Company Takes Over Florida Municipal Plant.—The Valdosta Lighting Company of Valdosta, Ga., has taken over the municipally owned light and power plant at Madison, Fla., the consideration being, it is understood, in excess of $30,000. As soon as possible a transmission line will be constructed from the hydro-electric plant at Valdosta to Madison at an estimated cost of $50,000. The Madison plant will be held in reserve as an accessory steam plant. The Valdosta plant was purchased recently by A. E. Fitkin & Company of New York.

Los Angeles Puts New 4,000-Hp. Unit in Service.—The Bureau of Power and Light of Los Angeles placed the first 4,000-hp. unit of its Big Pine power plant in operation on July 31, one week ahead of schedule. Work on the installation was speeded up in order to be able to furnish emergency service to a number of mines and industrial plants in the Owens Valley region which were temporarily without power because of damage done to the feeder lines of the Southern Sierras Power Company during a violent electric storm and cloudburst. Power from the Big Pine power plant is to be used in pumping water from approximately 300 wells in Owens Valley into the aqueduct for the water department of the city of Los Angeles.

Men of the Industry

James P. Britt of the Los Angeles office of the Railroad Commission of the State of California has been appointed assistant secretary to the commission.

C. C. Stewart, local manager of the Oklahoma Gas & Electric Company at Drumright, has been appointed manager at Norman to succeed Frank Carder, resigned.

C. Planche, who was formerly connected with the irrigation branch of the Canadian government, has joined the engineering staff of the Calgary Power Company.

S. J. Magee, vice-president of the Associated Gas & Electric Company, is now also a vice-president of the Staten Island Edison Corporation, which is controlled by the Associated company.

James R. Wood, superintendent of the Illinois Power & Light Corporation at Champaign, Ill., has resigned to assume other duties in Kokomo, Ind.

J. R. Johnson, formerly chief operator at the El Dorado plant of the Western States Gas & Electric Company, has been appointed superintendent of hydro generation with offices in Placerville.

Ralph D. Wichman, electrical and civil engineer with the Pacific Gas & Electric Company, San Francisco, for the past three and a half years, in charge of design of transmission substations, distribution substations, steam generating stations and steam-heating plants, is now associated with Wichman & Albers, engineers' service bureau, San Francisco.

Frank R. Jamison, formerly owner of the *Canadian Record*, a newspaper of Canadian, Tex., and the organizer of the Panhandle Press Association, has been appointed director of publicity for the Public Service Company of Colorado. His headquarters will be at Denver, and he will have jurisdiction over the entire publicity of the company throughout Colorado and contiguous territory. Speaking of Mr. Jamison's selection, Vice-President Stannard says: "In selecting Jamison for this difficult and important position we have obtained a man with wide newspaper experience. He has been in close contact with the public for many years and will capably interpret the policy of the company to the people of Colorado."

Frank J. Meyer of Oklahoma City, general superintendent of the Oklahoma Gas & Electric Company, who became affiliated with that organization in 1902 as an apprentice, was named July 27 by J. F. Owens, vice-president and general manager, to succeed the late H. W. Reilly as assistant to the general manager in charge of operation. Shortly after entering the employ of the Oklahoma utility Mr. Meyer entered Pratt Institute of Technology at Brooklyn, from which he was graduated. After spending two years in Porto Rico as assistant electrician for the Guanica Central Sugar Company and for a few months as a factory superintendent, he returned to Oklahoma City and again took up work with the Oklahoma Gas & Electric Company. He was successively chief electrician, superintendent gas department, electrical engineer and general superintendent.

H. G. Scott Heads Servel Corporation

H. G. Scott has resigned as vice-president of the Columbia Gas & Electric Company to take the chairmanship of the board of directors and the executive committee of the Servel Corporation, which he will personally operate. Mr. Scott and associates have purchased a fifty per cent interest in the company, according to an announcement made at the offices of the Servel Corporation on August 10.

Mr. Scott has a remarkable record

H. G. SCOTT

as a builder of properties. Going back ten years he has three big achievements to his credit. First, as vice-president and general manager, he built from nothing the Virginian Power Company, which is now a splendid property owned by the American Gas & Electric Company. Second he headed, as president, a syndicate that bought Nitro, West Va., an ammunition manufacturing town that was built by the government during the war as part of the line of defense behind the Appalachian Mountains. This town and the mills and factories that went with it cost eighty-three million dollars to construct. It was built in the wilderness, and when the war stopped it was deserted and left to decay from disuse. Mr. Scott took this useless property in hand and built an organization to sell the war material and transform the whole property to peace-time uses. He succeeded, and now it is a new, ready-made industrial town, thriving in a spot where a few years ago there was nothing but wilderness.

From Nitro Mr. Scott turned to the Columbia Gas & Electric Company, where as vice-president he was actively engaged in buying and selling properties, mapping out plans for expansion and organizing the personnel to build a great property. The story of the phenomenal growth of the Columbia Gas & Electric Company as a property during the past three years is well known to electric light and power men.

F. M. Black, vice-president in charge of finances of the Winnipeg Electric Company, has been chosen as honorary treasurer of the Industrial Development Board of Manitoba.

J. S. Fogerty, who was engaged in electrical construction work with the Phoenix Utility Company, Guatemala, Central America, during the past year, has recently entered the electrical engineering department of the Brooklyn Edison Company.

Herbert K. Nock, formerly of the engineering staff of the Lynn works of the General Electric Company, has been appointed electrical engineer of the Newburyport (Mass.) Gas & Electric Company and began his new duties on August 1.

Thomas E. Mattson, formerly of the Massachusetts Institute of Technology research staff under Dr. E. B. Millard, has been appointed commercial heating engineer of the commercial and industrial division of Charles H. Tenney & Company, Boston. Among other duties, Mr. Mattson will concentrate attention upon industrial electric heating problems and developments on the central-station systems under this group management.

Charles F. Goob, chief engineer of the Electrical Commission, Baltimore, has been appointed head of the Bureau of Mechanical-Electrical Service, one of ten bureaus created by an ordinance recently passed by the City Council. The ordinance creates the Department of Public Works, in charge of a chief engineer, and under which the ten bureaus will operate. Under the provisions of the measure the Electrical Commission is abolished.

George E. Emmons, who retired last November from the office of vice-president of the General Electric Company in charge of manufacturing, received a fitting tribute from his former associates when a bronze tablet in his honor was unveiled at the Schenectady plant of that company July 15. The tablet is the work of Chester Beach and was provided by contributions from thousands of employees in the plant with whom Mr. Emmons was associated during his service with the General Electric Company. E. W. Rice, Jr., honorary chairman of the General Electric board and an intimate associate of Mr. Emmons during the fory-five years of his service, spoke at the unveiling.

Frederic A. De Lay, formerly head lecturer for the Chicago Central Station Institute (educational bureau for the Insull companies), has opened an educational bureau, to be known as the Public Utility Institute, in Chicago. Courses of special value to utility companies and their employees will be conducted. In addition to eleven years with the Insull companies, Mr. De Lay has been head of the electrical engineering department in Colorado and Texas colleges and has taught in the Michigan College of Mines, University of Wisconsin and University of Michigan. He has also had much practical

experience in consulting engineering and contracting work. Mr. De Lay is a member of the American Institute of Electrical Engineers, Society for the Promotion of Engineering Education, Illuminating Engineering Society and National Electric Light Association.

C. E. Rentchler, superintendent of the Enid district of the Oklahoma Gas & Electric Company, has been appointed local manager at Drumright to succeed C. C. Stewart, who has been transferred to Norman.

R. C. Kumler, auditor of the eastern division of the Oklahoma Gas & Electric Company with headquarters at Muskogee, has been appointed local manager at Sulphur to succeed C. L. Owen, who has been transferred to the Enid district.

F. R. Combes, for the past three years chief assistant in the switchgear development department at the works of the General Electric Company, Wilton, Birmingham, England, is now in New Zealand, where he has assumed the duties of electrical engineer for the Auckland branch of A. S. Peterson & Company, agents for the Swedish General Electric.

Charles M. Swift, president of the Manila Electric Corporation, and **R. B. Marchant**, vice-president, have resigned. **John H. Pardee**, formerly vice-president, was elected to the presidency, and **J. I. Mange** was made vice-president to fill the vacancy. Other officers of the corporation are Joseph K. Choate, H. C. Hopson, S. J. Magee and J. M. Daly, vice-presidents, and T. W. Moffat, secretary and treasurer.

C. A. Johnson, formerly power plant and substation engineer of the El Paso (Tex.) Electric Company, has been transferred to the Lowell (Mass.) Electric Light Corporation, where he will perform similar duties. Both these properties are under Stone & Webster management.

George V. W. Ingham, for the past three years Eastern sales manager of the Johns-Pratt Company, has resigned from that position. Mr. Ingham is widely known among electrical men. In 1910 he joined the sales organization of the Bryant Electric Company and covered the Chicago office territory, including the Southern States and the Southwest. After serving eight years as field representative in the Western territory of the Bryant company, Mr. Ingham was made Eastern sales manager with headquarters at Bridgeport, Conn. When in 1922 the Johns-Pratt Company established its own sales organization Mr. Ingham accepted the position of Eastern sales manager of that company, with headquarters in New York. He is now considering the matter of serving as a special manufacturers' agent in the Eastern territory.

Obituary

John D. Healey, president of the Holmes Electric Company, Baltimore, died suddenly August 4. Mr. Healey was a native of Barrow-in-Furness, England, and was thirty-one years of age.

Commission Rulings

Valuation of Water-Power Rights Affected by the Public's Interest Therein.—In a valuation for rate-fixing purposes of the Rockford Electric Company's property, the Illinois Commerce Commission dealt with the interest of the public in water-power sites as affecting the amount to be allowed in the valuation to the company developing a site. The commission said: "In pricing the water-power rights owned by the Rockford Electric Company Hagenah & Erickson [engineers retained by the company] and the company's own engineers pursued the same method. The operating expense per kilowatt-hour generated in the company's water-power plant was compared with the operating cost per kilowatt-hour of electrical energy generated in its steam plant, and the saving on the total energy generated by water power was capitalized at a given per cent and the result set forth as the value of the water-power rights and equipment. In analyzing the records of the Rockford Electric Company the commission's engineers found a record of the transfer to the Rockford Electric Company of a portion of these water-power rights and estimated the cost of the entire share of the Rockford Electric Company in the water-power rights in the Rock River at the rate shown in the aforesaid record of transfer. The engineers representing the utility differed on one point: The utility's own engineers set up in their appraisal the whole amount of the capitalized value, claiming it all as the property of the Rockford Electric Company, while Hagenah & Erickson included in their appraisal one-half of the total value of the water-power rights, stating that in their opinion this was all that should be capitalized against the people of the city of Rockford, the other half accruing to the citizens of Rockford for their foresight in establishing a city at a point where water power was available. The question here involved has heretofore been in issue in cases decided by this commission and its predecessor, and *in re* Montgomery Hydro-Electric Company the matter is discussed in the following language: 'The fact that a community has developed in the vicinity of a water power gives the water power its value since it creates a demand for the service which the water power may develop, and in most cases it is doubtless true that the growth of communities in such locations has been largely predicated upon the existence of the water power. Therefore, it might be unfair and unreasonable to assume that a community having grown up through the foresight of its individual citizens in locating themselves near a water-power site should at some later date be penalized to an extent which would place it upon the same basis as would have existed had the water power not been there located.' The same decision quotes from the decisions of a similar trend rendered by other commissions. It seems to be a well-settled principle that in valuing water-power rights some consideration should be given in fixing the value to the very evident interest of the public in such water powers. For the purpose of fixing rate-making values herein this commission will adhere to the principles laid down by its predecessors and those adhered to by other commissions in like cases."

Principle of Uniformity Enforced in Tennessee.—Asserting that the existing rates were "unreasonable, unequal and discriminatory," the Railroad and Public Utilities Commission of Tennessee has ordered uniform electric rates to be established in the twenty or more towns in that state served by the Southern Cities Power Company and its parent company, the Southern Cities Utilities Company. The new rates, which are based on those charged by the Tennessee Electric Power Company in the towns it serves, make small increases in some places and small decreases in others, the increases applying mainly to large users. Their total effect is to leave the revenue of the company almost stationary.

Special Reserve for "Contingencies" Disapproved.—The Illinois Commerce Commission has disapproved the action of the Rockford Electric Company in setting up a "reserve for contingencies," to which the company for three years credited 1 per cent of its gross revenue, the fund totaling at the time of the hearing more than $36,000 and nothing having been charged against it. The company explained that the fund was meant to defray "losses incident to fire, flood, cyclone, storm, etc., not occasioned in the ordinary course of business." The commission held that such contingencies are normally taken into account in fixing the allowances for insurance and retirement expense and that adequate allowance should be made for them without setting up a special fund.

Recent Court Decisions

What Is "Seasonal" Occupation with Light and Power Company?—In Lincoln Gas & Electric Company vs. Watkins, the Supreme Court of Nebraska held that the State Legislature had, in a state compensation law, used the word "seasonal," in referring to an occupation, in its accepted sense of meaning work that could be performed only in certain seasons rather than meaning a voluntary change of occupation with the seasons. A lineman for whose death compensation was claimed worked in summer and attended a university in winter. The company contended his work was therefore seasonal and that the compensation should be based on a certain percentage of his total annual earnings, but the court held his occupation was not seasonal and that his compensation should be based on his weekly wages. (204 N.W. 391.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

The Near-by Latin Markets—Part I

Electrical Conditions in Venezuela, Colombia and the Central American Republics South of Guatemala

By R. A. LUNDQUIST
Chief Electrical Equipment Division, U. S. Department of Commerce

CLOSER attention could well be paid to such near-by Latin markets as Venezuela, Colombia, Central America and Mexico. It is true that they are backward in the use of electricity and that the purchasing power does not average as high as ours, but on the other hand conditions in those sections are improving steadily and the standard of living is rising. Individually, the countries are not large in population, but their potentialities are great in the aggregate and, with the development of their resources which is bound to take place, due to their proximity to this country, they will undoubtedly become better and better markets in all aspects. I will review the electrical conditions in these countries as I have recently observed them, considering first the larger group of countries that are less developed electrically, and then, in Part II, the two northernmost countries that present both the largest territory and market.

VENEZUELA A PRICE MARKET

Venezuela, though its population is only 2,500,000, has great oil resources in the vicinity of Maracaibo, which gives it a purchasing power greater than would otherwise be the case in its present stage of development. On the whole, there is already electric service available in practically all of the cities of that country, but lack of sufficient generating equipment to meet the demands, especially in the case of the larger cities, and a rather high level of rates have restricted the expansion that would otherwise take place. Another deterring factor has been the attitude of owners of local lighting plants, who were seemingly content to let an installation remain in its original state until absolutely forced to make expansions, and made little attempt to push the sale of electric service.

At the present time distribution systems are rather poorly maintained as a general thing, and voltage conditions are none too good, with frequent interruptions of the service. Homes and business houses are inadequately illuminated in most instances and while the larger industries have their power demand fairly well taken care of, there appears to be still a good amount of small motor business that can be developed.

In the line of wiring devices and the like, Venezuela is a price rather than a quality market. There has apparently been very little effort made to push quality lines even among the class of people who are able to buy them. Operators of central-station systems have done little to promote better standards.

Exports of electrical equipment from the United States to Venezuela were $444,548 in 1920 and $420,509 in 1924.

COLOMBIA AND FLAT RATES

Colombia is a market similar in some respects to Venezuela, but has a population of about 5,800,000. There are extensive oil resources in this country also, but the development has as yet hardly been as great as in Venezuela.

MR. LUNDQUIST has recently returned from a trip through Mexico, Central America and the republics of Venezuela and Colombia looking over the conditions of the electrical markets. He has written this high-spot report of his trip for the information of American manufacturers, and frankly gives his opinion as to the possibilities for the development of business for American products in each country. Mexico and Guatemala, the most highly developed field of near-by Latin America, will be discussed in Part II next week.

The electrical practice in Colombia appears to be much the same as that in Venezuela and the attitude of central station operators as regards new business is not greatly different. As in Venezuela, there are a great many flat rate consumers and the high monthly rate charged on individual appliances tends to keep down the number of such devices that are purchased. There is some use of electric irons, but on the whole progress in the appliance field is not great. It is said that flat-rate consumers would oftentimes have an electric iron which they would use illicitly, but, of course, no volume of business can be built up on any such basis.

While the general development of Colombia, electrically speaking, is no better or probably not quite as uniform as that of Venezuela, the volume of business is larger on account of the population, our exports to that country being about double what they are to Venezuela.

Exports of electrical equipment from the United States to Colombia were $955,293 in 1920 and $777,466 in 1924.

Among the Central American republics, Panama, the most southerly, is difficult to class as a foreign market, since the American influence in the electrical development there is so strong, due to the proximity of the Canal Zone, that it is more or less standardized along American lines. A well-known American holding company operates central stations at Colon and Panama City, and outside of these two towns there are only two small public service plants. A great deal of American electrical material is constantly purchased for the Canal, but since that is all American territory, and since the buying is handled by the Canal Commission, that business must be classed as domestic. Little foreign electrical material was seen in Panama, and was confined to lamps, a few cheap fans and some low-priced wiring devices from Europe. It might be expected that electric fans would be a good selling appliance in Panama City and Colon, but this is not true, and it is said that considerable effort had been made to push fans in that market without much success. Undoubtedly there is considerable sales resistance in any Latin country when it comes to selling anything that produces a breeze, since the people greatly fear exposure to any sort of a draft. However, Oriental countries with climatic conditions very similar have generally adopted fans, and it is believed that in the course of time progress will be made in these Latin markets.

Exports of electrical equipment from the United States to Panama were $879,011 in 1920 and $515,036 in 1924.

COSTA RICA MORE ADVANCED

Costa Rica, with a population of only about 450,000 people, and with resources that are largely agricultural, cannot, of course, absorb a great volume of electrical goods, but is a consistent customer of our manufactures. Much of the buying throughout the Gulf side of the country is controlled by American fruit corporations operating there, and such business is generally placed by purchasing agents in the States. The natural commercial center of the Republic, however, is San José, the capital city.

With two hydro-electric companies competing for business in San José, there has been considerable selling activity; the electrical development of that town has been very good. The standard of illumination is considerably higher than in other countries to the south and there is a fair use of appliances, though here, as in other countries, the use of appliances has been restricted by the flat rate method of charging which is in effect. Central station engineers reported that while their records showed quite a number of electric irons, they felt that only about

one-half of the total appeared on their books, since the people had a habit of buying two-way plugs and using irons on their flat-rate outlets without going through the formality of paying for the extra service.

Electric cooking has been developed to a greater extent in San José than in any other city visited on this trip. It has reached the stage there where prospective cooks often ask a householder if the home is equipped with an electric stove. Ranges are carried on a flat rate per month, according to the wattage. The most common type is a three-heater stove, with an oven below. Another factor affecting the sale of appliances is the lack of day current, except in a few larger cities. In one small city where no day current was available the owner of a hotel operated an electric washer in the evening and then had the servants iron the clothes with charcoal irons the following morning. In spite of the trouble, he found the use of the washing machine saved enough on the wear and tear of the linen to make it worth while.

Exports of electrical equipment from the United States to Costa Rica were $134,815 in 1920 and $194,994 in 1924.

Nicaragua Backward

Nicaragua, one of the two least developed of the Central American republics, has a population of only 700,000 and even in the boom year of 1920 took only $106,000 worth of electrical goods from us, while in 1923 our total exports to that country were only $69,000. Managua is the chief commercial center, with Leon and Matagalpa also important business communities. Corinto, on the west coast, is the principal port of entry for electrical goods. On the whole, electrical development is not great and while a hydro-electric system was recently initiated in Leon, the few public service plants operating are largely wood burning. Distribution systems are indifferently constructed and service rather poor. Flat rates predominate and twenty-four-hour service is naturally not common. American manufacturers were getting the bulk of what little apparatus business was offering, but there was an increasing amount of German wiring devices, lamps and appliances coming in. The electrical business is in the hands of general importers who give little attention to that phase of their business.

Exports of electrical equipment from the United States to Nicaragua were $171,577 in 1920 and $133,497 in 1924.

Honduras More Backward

Honduras was eliminated from the schedule of the writer because of lack of time and the difficulty of access to the principal city. It is a market much similar to Nicaragua, according to reports of engineers in adjacent markets who are familiar with conditions in the republic. Probably a good portion of the electrical business originating in that country has resulted from American mining, timber and fruit developments. With its relatively large area, Honduras is one of the more important of the Central American republics in potentialities, but in actual development it is one of the slowest to make progress.

Exports of electrical equipment from the United States to Honduras were $135,160 in 1920 and $172,795 in 1924.

San Salvador Progressive

San Salvador is the most densely populated of the Central American republics and has 1,300,000 people in an area of only 7,225 square miles. It is a progressive country and at the present time is prospering greatly from the high coffee prices. It has for many years been a consistent market for American electrical goods. There is abundant water power in the country and practically every large public utility power system is hydro-electric. The operation of public utility systems is along more progressive lines than was noted in some of the other countries visited. Wiring practice is not on a very high plane, however, in most cases, the common practice being to use open cleat and knob work, with weatherproof and slow burning Underwriters' wire for conductors. Very little rubber-covered wire is employed, but snap switches of American type and plug fuses are standard.

The only electric appliance that is in use to any great extent is the flat iron, and even this has by no means the widespread sale that we are accustomed to in this country. Few electric toasters are seen because, as in other Latin countries, the people like French rolls. They have little use for vacuum cleaners because rugs and hangings are largely dispensed with. There are a small number of electric fans in use, because one of the companies has put them out on thirty-day trial, but even this plan has not produced the volume of business that might be expected.

Salvador has been a fair field for manufacturers of farm lighting plants, coffee plantations having been good customers during the last few years. It is said that local dealers favor sets without batteries wherever possible because the coffee plantations only operate about four or five months a year. At the end of the crop season they lock the door on the set and forget it, batteries and all, until the next season, which is naturally not a very sound method of handling a storage battery.

Exports of electrical equipment from the United States to Salvador were $181,819 in 1920 and $150,385 in 1924.

Number of French Inventions Increasing

The year 1924 saw 18,900 inventions deposited in the French patent office. Ninteen thousand two hundred were delivered. The excess is from the hangover of previous applications which had not hitherto been granted. Recording and granting of patents fell seriously behind during the war period and have not yet actually caught up. The number deposited was in excess of those of 1923 by 1,469. Since the war the tax for the deposit of the *brevet d'invention* in France has been increased from 100 francs to 125 francs. Certificate of deposit now costs 100 francs, increased from 20 francs.

Out of the 19,200 patents there were delivered to French inventors 12,237. This is a figure greater than in 1913, which may be taken as a normal year before the war. In 1913 there were delivered to French inventors patents to the number of but 7,532, foreigners having received 9,164. The increased proportion in favor of the French inventor today is a sign of the times.

Keeping Up the Spirit of Service

Advantages of Small Companies No Loss to Larger Jobbers if Proper Attention Be Given to Personnel

By Frederic P. Vose
Secretary-Treasurer National Electrical Credit Association, Chicago, Ill.

ONE occasionally hears the complaint of a large jobber about the alleged practices of some of his small competitors. The small organization may be getting more business than would seem reasonable, and the executive of the larger organization may feel somewhat suspicious of what he terms the "too successful jobber." Frequently in cases of this kind the executive of the large organization has overlooked the fact that the smaller jobber may be supplying the personal service in the merchandising of his commodities that may be lacking in the larger organizations. Analysis of several specific cases would indicate that the element of personal service constituted the chief reason for the unusual success of these particular jobbers.

Selection of Personnel

Many executives in large jobbing organizations have started their careers in the sales end of the business or as active managers of small organizations in which they have been careful to give personal, intelligent and conscientious attention to every customer and every detail of contact with the individuals who do business with them. As these men have moved upward in the organization the work which they have formerly done themselves must be delegated to others, and quite often is delegated to men who are less personally interested in the success of the business and less appreciative of the importance of the personal element in business success.

This condition has been corrected by many large jobbers by giving greater attention to the selection of the personnel that has to do with the buying public. These executives have further fortified their position by encouraging these men to study the problems of the jobber, particularly as related to the handling of individual buyers and the consideration given to details that have an important bearing upon the elimination of friction in trade relations.

In short, there are many large jobbers and executives who have found it less profitable to criticise the methods of smaller competitors than to give especial attention to the selection of the personnel having to do with the trade, a personnel that is disposed to study its job and that is encouraged in such study. These executives have found a way to carry over into the larger organization the elements of

personal contact and service that have been the cornerstone of the success of their smaller competitors. Such executives have been as much interested in how their customers have been treated and how they feel toward the jobber's organization as in what and how much the customer has bought.

Business Conditions

THERE is a typical summer market in the electrical industry this week. The New England territory has quieted down somewhat. The Middle West has picked up a little. Business elsewhere is in fair volume with the outstanding activity in California and the extreme Southeast. But the outlook for all business is considered excellent all over the country. Building construction is active, power systems are still expanding, and manufacturers are in a very optimistic mood. Copper and lead have advanced further, to 15 cents and 9 cents respectively. The United States Steel Corporation has reported a reduction of 170,991 tons in unfilled orders on July 31, which has been the smallest decrease in any month since orders began to fall off, due both to an increased demand for steel products and smaller shipments made in July.

There has been a distinct let-down in the Boston wholesale market and in the neighboring states, and stocks are low. Appliance sales are rather strong, however; also central-station transmission supplies. The New York district shows a fair volume of small orders only, with steady demand for transformers and line materials. Active buying continues in the Southeast, sales being principally to power companies and to contractors for small- or medium-size house construction. Industrial buying is light. Business has picked up some in the Middle West, with good demand for meters, pole hardware, radio and appliances. On the Pacific Coast there has been active central-station buying, including some sizeable range sales. Building construction is strong.

Electric Cranes and Hoists in Slightly Better Demand

A SLIGHTLY better demand for electric cranes and hoists has been noticeable by manufacturers since April. Although competition is keen and prices low, some stiffening has taken place and there is more of a tendency to close business than in any period in the previous year. Manufacturers believe that present business, as well as that conducted in the past year, is below normal as measured from the productive capacity of the ten leading crane builders. It is estimated that $15,000,000 would probably represent the total productive capacity.

Judging from the volume of inquiries pending and from the general trend of business conditions, it is believed that the crane business for this year will not exceed that of 1924 to any great extent, but manufacturers state that the possibilities of the market are increasing, are quite favorable and in time will broaden so that the demand will balance the total productive capacity. This is owing to the fact that cranes are being considered by various industries, particularly the metal industries, as vital to the successful handling of heavy equipment which must be handled in progress of construction and in the finished stage. In addition a great many industries, which were formerly not considered as regular users, are coming into the crane market, and there is a wider application of special cranes such as those equipped with buckets and magnets. Deliveries are good and it is possible to get cranes on a reasonably short time. Prices are low, and although there is no indication of a change, the price trend will quite likely be upward.

Non-Ferrous Metals Less Active—Copper and Lead Advance

THERE was less activity in the non-ferrous metal markets this week than last, but a good volume of business was recorded. Copper advanced to new high levels for the current movement, as did also lead, although lead buying continues to be restricted by the extremely limited offerings.

NEW YORK METAL MARKET PRICES

	Aug. 5, 1925 Cents per Pound	Aug. 12, 1925 Cents per Pound
Copper, electrolytic	14⅝	14.70
Lead, Am. S. & R. price	8½	9
Antimony	17½	18½
Nickel, ingot	33–34	33–34
Zinc, spot	7.90–7.92	7.90
Tin, Straits	59⅜	58
Aluminum, 99 per cent	27	27

Base copper price Aug. 12, 1925, 16½ cents.

Copper was selling last Saturday at 14⅝ cents for delivery to Connecticut points. On Monday this price shaded slightly, and good business was done at 14⅞ cents for the Middle West. On Tuesday the long-anticipated 15 cents price was realized on more than 1,000 tons in that market. In the East 14⅞ cents has been the top so far. The London market is weak. The volume of sales for the week has been above normal but less than the week before.

The contract price for New York lead set by the American Smelting & Refining Company was advanced to 8.90 cents on Saturday, August 8, and to 9 cents on Tuesday, August 11. The lead situation remains unchanged from last week, with insufficient supplies and the largest producers trying to prevent a runaway market.

Copper Association Predicts Two Million Radio Sets This Year

THE Copper and Brass Research Association has just completed a survey of the radio industry and finds that in 1922 there were hardly 100,000 radio sets in use; in 1923 the number had grown to 2,000,000, in 1924 to 3,750,000, and by the end of 1925, the association estimates, the number of sets in use will reach a total of 5,000,000. The retail value of sets and parts has grown from $50,000,000 in 1922 to an estimated $500,000,000 in 1925.

The present rate of manufacture, according to the association's survey, indicates that 1925 production will be 2,000,000 sets, in which the consumption of copper and brass will be about 7,750,000 lb.

New England Sales Slowing Up

THE past week throughout New England was marked by a tendency to slow up in buying electrical supplies and equipment. Jobbers report dull business and few orders for supplies and, in addition, a policy to hold stocks in reduced quantity for the time being. On the other hand, as the result of a brief survey of department stores, one manufacturer records optimistic conditions and encouraging prospects for the fall. Interest in household appliances is growing. The demand for irons, fans, lamps and ranges has been quite active in spite of the unseasonable weather.

House-wiring devices, wire, pipe and fixtures are selling well, but orders for these are well scattered and generally are in small lots. Transmission-line supplies are steady. Poles, cross-arms, conduit and insulators are moving in good volume. Small motors are in good demand and farm power units are attracting attention.

Interest in industrial lighting and heating is increasing, and many inquiries concerning installations are being received. One paper mill in Massachusetts has closed a power contract for 2,000,000 kw. a year for a term of five years. The Westinghouse Electric & Manufacturing Company reports receiving a contract for a 20,000-kw. generator to be delivered to an eastern Texas power plant.

Business in Southeast Holding Steady

ELECTRICAL business in the Southeast for the past week has undergone little change from that of the several weeks preceding, and no activities of outstanding importance can be reported. Conditions still continue spotty, with normal all-around activities reported from the Florida territory, where there is little prospect of an abatement of the demand. Birmingham and portions of Alabama continue to supply a reasonably good volume of orders, principally for construction materials and central-station supplies entering into distribution systems for the small communities. Business in south and middle Georgia shows some improvement, and from the larger centers there comes a satisfactory volume of commercial construction-material orders covering panelboards, wiring supplies, lighting fixtures and ceiling fans. Orders from industrials, however, are reported slow, with purchases by steam railroads only fair at this

time. Local contractors are purchasing wiring materials, safety switches and other supplies for small and moderate class construction in reasonable volume.

Jobbers report little activity this week in the electric range line, and few orders of moment for fall supplies have as yet come in either for socket appliances or hollow ware. New Orleans holds promise of considerably increased volume of business this fall on account of the unusually large building program and the activities just getting under way on the Gulf Coast. The general crop outlook in the Southeast promises excellent business activities for the coming fall if the situation is viewed from a broad angle, yet there are sections where lack of rains have hurt agricultural conditions very badly, and where little or no money will be available for fall activities.

New York Market Dull but with Bright Prospects

BUSINESS in the New York district is in fair volume and manufacturers are very optimistic as to sales this fall. There is a steady demand from central-station companies for transformers and distribution equipment. A few interesting orders were also placed for pole-line hardware, but they were not considered large. One manufacturer in the large-apparatus field reports that his sales this month are expected to be quite extensive. Another manufacturer of transformers says he has been receiving a good amount of business and will be forced to lengthen his deliveries if orders continue at the same rate.

Wire and cable sales have been in fairly good quantity, perhaps a little more than would be normally placed at this time. Manufacturers believe that this volume has been more or less forced on the market ahead of its time by a strong metal position and by sales that normally would have been made a little later. The demand for general-purpose motors continues to hold up well and, based on inquiries sent out, shows signs of steady improvement. Jobbers report buying as conservative, with many orders for small quantities of material. Present business is largely sustained by purchasing for subway construction work. Orders for maintenance material are slow. National campaigns now being conducted by heating appliance manufacturers are expected to increase the demand for this equipment considerably.

Value of Electrical Exports for June, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

	June 1924	June 1925
Generators:		
Direct-current:		
Under 500 kw.	$70,963	$41,590
500 kw. and over	124,594	5,062
Alternating-current:		
Under 2000 kva.	17,795	31,632
2000 kva. and over	.....	49,900
Steam-turbine generator sets	240	29,470
Accessories and parts for generators	229,471	52,012
Self-contained lighting outfits	69,185	58,199
Batteries:		
Flashlight batteries	94,920	86,902
Other primary batteries	68,588	88,315
Storage batteries	237,164	198,921
Transforming or converting apparatus:		
Power transformers	236,803	110,202
Other transformers	222,995	112,663
Rectifiers, double-current and motor generators, dynamotors, sychronous and other converters	143,025	87,953
Transmission and distribution apparatus:		
Switchboard panels, except telephones	183,307	79,502
Switches and circuit breakers over 10 amp.	372,749	90,826
Fuses and fuse blocks	20,307	22,506
Watt-hour and other measuring meters	14,624	31,231
Volt, watt and ampere meters and other recording, indicating and testing apparatus	116,420	144,346
Lightning arrester, choke coils, reactors and other protective devices	59,130	45,770
Motors, starters and controllers:		
Motors under 1 hp	190,830	147,172
Stationary motors:		
1 to 200 hp.	136,208	152,447
Over 200 hp.	25,891	33,360
Railway motors	94,499	21,619
Electric locomotives:		
Railway	468,680	.....
Mining and industrial	9,014	22,497
Other motors:		
Starting and controlling equipment:		
For industrial motors	95,389	76,559
Electric railway and vehicle motors	1,239	10,009
Accessories and parts for motors	225,985	117,384
Electrical appliances:		
Electric fans	98,845	107,154
Electric lamps:		
Metal-filament	90,134	87,972
Other electric lamps	24,728	33,952
Flashlights	74,596	115,121
Searchlight and projectors	$23,955	$40,457
Motor-driven household devices	74,476	93,421
Domestic heating and cooking devices	81,565	110,875
Industrial electric furnaces and ovens	16,744	34,015
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	101,807	139,403
Signal and communication devices:		
Radio apparatus	307,884	670,605
Telegraph apparatus	89,154	32,581
Telephone apparatus		
Magneto telephones	14,201	5,672
Other telephones	63,255	38,214
Telephone switchboards	127,549	31,444
Other telephone equipment	167,474	141,560
Railway signals, switches and attachments	33,782	77,094
Bells, buzzers, annunciators and alarms	19,445	16,859
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	178,408	394,899
Insulating material	133,340	130,013
Metal conduit, outlet and switchboxes	51,710	55,404
Sockets, receptacles and lighting switches	102,473	120,900
Electric lighting fixtures, interior and street	48,329	85,021
Other wiring supplies and line material	106,847	67,727
Other electrical apparatus	600,063	440,562
Globes and shades for lighting fixtures	21,340	39,199
Electrical glassware, except for lighting	32,678	15,870
Electrical porcelain	175,991	(†)
Less than 6,000 volts	(*)	44,699
6,600 volts and over	(*)	50,210
Electrical carbons, carbon brushes and electrodes	253,733	(†)
Electrodes for electric furnaces	(*)	91,551
Other carbon products	(*)	227,454
Insulated wire and cable (iron and steel)	33,124	18,988
Other manufactures of aluminum	43,731	50,823
Copper, bare wire	227,399	114,952
Copper insulated wire and cables	252,448	318,856
Total electrical machinery and apparatus and supplies	$7,201,223	$5,991,636

(*) Not separately stated prior to January 1, 1925.
(†) Discontinued beginning January 1, 1925.

General Quickening of Middle West Business

THE first week in August has witnessed a general quickening in business in the Middle West territory, and indications point to an active autumn season. Thoughts of a possible coal strike are causing some uneasiness in coal regions but have not as yet reached sufficient proportions to dampen the general optimism. Various utility companies are actively planning for greater expansion of the territories covered, while in the Chicago district plans are being outlined for a growth of population to 6,000,000 inhabitants. Central-station purchases have been quite heavy, although equipment purchases have been somewhat light. There has been a good demand for meters, insulators and pole-line hardware.

Jobbers' sales accelerated somewhat this week. Appliances have movod well, with a good demand for radio equipment. Prices remain firm. The base price of copper advanced 0.5 cent per pound, and there was a stiffening in other metals. Outlet boxes were placed on a delivered basis in the Chicago district.

Pacific Coast Market Strong—Building Outlook Good

POWER company buying has been somewhat active this week on the Pacific Coast, including a 10,000-piece pole-line hardware order and three carloads of ranges, both sold to San Francisco, where there was also an inquiry, not as yet placed, for 500,000 lb. of $\frac{3}{8}$, $\frac{1}{4}$ and $\frac{5}{16}$-in. double-galvanized strand wire. Industrial business is good, especially from the Eureka district, where 10,000 lb. of bare copper wire and 200 externally operated switches, sizes 100 amp. to 400 amp., went to a lumber company. Railroad purchasing is quiet and in small lots covers such items as wiring supplies, spoons and anchor rods. Dealers' and contractors' business is spotty. Business continues excellent, but lighting fixtures and floodlights are furnishing the best prospects at present, especially in the San Francisco district. A lighting job costing $7,500 for the University of Arizona is reported awarded to the Guth Company. Prices in all lines are steadier. Copper wire has advanced 25 cents per 100 lb. to a new base of $20.25, but rubber-covered wire has receded somewhat from its recent sharp advance.

Assurances of good crops in the eastern Washington farming and fruit section and also in the Puget Sound district are converting farm-lighting inquiries into orders already, this early in the season, with the peak of the volume expected the latter part of September and early in October when harvest is over. Owing to continuous hot weather fan sales have been excellent and dealers' and jobbers' stocks are practically exhausted. With the end of the vacation season approaching, range sales are increasing and plans for campaigns are being formulated. Stocks of appliance lines are low and considerable ordering is being done, with the demand increasing.

Activities of the Trade

N. I. A. A. Convention Chairmen Announced

Appointment of chairmen for important committees shows progress in the plans for the convention of the National Industries Advertisers' Association to be held at the Chalfonte Hotel, Atlantic City, October 19, 20 and 21. One new appointment was that of J. N. McDonald of the Anaconda Copper Mining Company, New York, incoming president of the Technical Publicity Association, to be chairman of the On-to-Atlantic City committee.

Other chairmen named are D. J. Benoliel of the International Chemical Company, Philadelphia, to head the exhibit committee; Hoyt Catlin of the Bryant Electric Company, Bridgeport, to head the entertainment committee, and H. J. Downes of the American Locomotive Company, New York, to head the transportation committee.

Organization of the general committee has been completed. W. A. Wolff of the Western Electric Company, New York, is chairman. The other members are J. L. Ashcroft, Ludlow-Saylor Wire Company, St. Louis; Joseph C. Bowman, Cleveland; Ezra Clark, Clark Tructractor Company, Buchanan, Mich.; O. C. Dahlman, Koehring Company, Milwaukee; W. S. Hays, National Slate Association, Philadelphia; Mr. McDonald and A. M. Staehle, Westinghouse Electric & Manufacturing Company, East Pittsburgh.

Copeland Products Announces New Personnel

Copeland Products, Inc., of Detroit, manufacturer of electrical refrigerating systems, announces the election of William Robert Wilson as president. Previous to joining the Copeland company Mr. Wilson was for several years personal assistant to the Dodge Brothers, vice-president of the Irving National Bank of New York and later president of the Maxwell Motors Corporation. Under the new plan of organization, the plant of Copeland Products, Inc., has been moved from Flint, Mich., where it had been operating for two and one-half years, to Detroit, to provide quarters for larger production facilities

E. J. Copeland, who is vice-president and secretary of Copeland Products, Inc., was the founder, president and general manager of the Kelvinator Corporation. He has been associated with the electrical refrigerating industry for the past eleven years.

E. S. Barber goes to Copeland Products as vice-president and general sales manager. He was for six years general sales manager of Society Brand Clothes, for two years a director of the company and was later on the executive staff of the United States Rubber Company. Production will be in charge of Fred F. Brueckner, who was for eight years with the Singer Sewing Machine Company, designing machinery, was chief tool designer for Studebaker and Dodge Brothers, adviser to the United States ordnance and aircraft departments during the war, production engineer for General Motors and engineer of production for Maxwell-Chrysler.

Manual Lassen becomes chief engineer. For five years he was an engineer of Continental Motors, then assistant chief engineer for the Frigidaire Corporation, then designer and co-patentee of the Nizer Commercial Refrigerating System and a consulting refrigerating engineer for two and one-half years.

Spaulding Fibre Company Opens New Branches

The Spaulding Fibre Company, Inc., has recently added to its service by establishing branches in Detroit, Cleveland and Cincinnati. These new branches materially strengthen the company's service facilities, consisting already of branch offices and warehouses located in New York, Chicago, Philadelphia, Boston, Paris and London; in addition to which the Buffalo district is served direct from the main factory at Tonawanda, N. Y.

Each branch is equipped with fabricating facilities which materially help in filling orders, not only for the standard forms of fiber cut to size, but for special shapes and parts, such as blocks, strips, washers, condenser ferrules, disks, rollers, truck wheels, radio parts and other special shapes.

A short time ago the Spaulding company completed a new paper mill and a modern water pumping station, complete with a large filtration plant, in order to be in a position to control quality from raw material to finished product.

W. J. Jones Foundry & Machine Company, 51 West Roosevelt Road, Chicago, manufacturer of power transmission equipment, has opened a branch office in Minneapolis at 614 Builders Exchange. F. S. Van Bergen is district sales manager. The territory covered from the office will embrace all of the Minnesota, North Dakota and South Dakota, also parts of Iowa and Wisconsin which adjoin Minnesota. The Minneapolis office will handle the sales of the entire Jones line in its territory.

Tampa Hardware Company, one of the largest wholesale jobbing houses in the South, announces the addition of a complete jobbing line of electrical equipment and appliances, as well as radio, including complete receivers and parts. This department will be under the management of W. R. Phillips, formerly of the Western Electric Company at Richmond, Va.

Paul W. Koch & Company, 19 South Wells Street, Chicago, announces the appointment of the following representatives for the sale of their "Jiffy" products: J. A. Dupree, 130 Belden Avenue, San Antonio, Tex., will cover the state of Texas; Henry Nixon, 509 Mutual Building, Kansas City, will cover western Missouri, Nebraska, Kansas and Oklahoma; and the Dickie-Wehner Sales Company, 1406 Keenan Building, Pittsburgh, will cover western Pennsylvania, eastern Ohio and West Virginia.

William W. Huselton, 43 Cedar Street, New York, N. Y., has been elected vice-president and treasurer of a company now being organized to manufacture electric storage batteries. Arrangements have been made for the purchase of the former mill of the Smith Tire & Rubber Company, Garfield, N. J. The property aggregates 30,000 sq.ft. of floor area and will be equipped soon. The battery company will be capitalized at $2,500,000.

Utility Men Buy Into Servel

Fifty per Cent Interest in Electric Refrigerator Company Acquired by Utility Group—H. G. Scott Heads Board—Extensive Development Ahead

A GROUP of public utility men, headed by H. G. Scott, vice-president of the Columbia Gas & Electric Corporation, has acquired a 50 per cent interest in the Servel Corporation and will immediately take an active part in the direction of the company's affairs. Mr. Scott will resign his position with the Columbia Gas & Electric Corporation and will take the post of chairman of the board of directors of the Servel Corporation. Harry G. Seaber, president of the Servel Corporation, will continue in that office but will be able to devote more attention to the sales department and to the development of broader markets for the domestic electric refrigerator. E. A. Graham, formerly with the Electric Bond & Share Company, has joined the Servel Corporation as head of a new department to have charge of relations with public utility companies.

The entrance of these new interests will probably mean the recapitalization of the company and the purchase or building by it of its own plant. At present all its manufacturing is done by the Hercules Corporation, but existing plans call for the development of a company-owned plant. A great national advertising campaign is planned.

The Servel refrigerator is one of the best known electrical refrigerators now on the market, and the company in its three years of existence has shown steady growth and development. Its machine is now handled by a large number of central stations in all parts of the country, and the company will continue its work of market development in close co-operation with the power companies, in line with the policy that has been followed since the beginning. The class A common stock of the corporation, which was brought out in March, is now selling at about $28 a share.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Warsaw, Poland (No. 16,192), for incubators, breeding apparatus and supplies for poultry and animals.

An agency is desired in The Hague, Netherlands (No. 16,160), for electric trucks, transformers and large rectifiers.

Purchase is desired in Beirut, Syria (No. 16,221), of electrical can-making equipment.

Purchase is desired in Talcuhuano, Chile (No. 16,151), of electrical installations, stoves, irons and fans.

Purchase is desired in Montevideo, Uruguay (No. 16,161), of electric heating appliances.

Purchase is desired in London, England (No. 15,158), of electrical household appliances.

Purchase and agency is desired in Hamburg, Germany (No. 16,153), for electric household appliances and coffee roasters.

Purchase is desired in Weltevreden, Java (No. 16,152), of small lighting plants, waterwheel.

Purchase is desired in Rio de Janeiro, Brazil (No. 16,155) of self-contained, oil-engine lighting set.

An agency is desired in Soerabaya, Java (No. 16,154), for radio equipment.

Purchase is desired in Newcastle, England (No. 16,150), of radio parts and accessories.

An agency is desired in Arras, France (No. 16,159), for radio parts and accessories.

An agency is desired in Belfast, Ireland (No. 16,157), for tube radio sets.

An agency is desired in Bombay, India (No. 16,156), for radio sets and parts.

Purchase is desired in Bochum, Germany (No. 16,211), of high-speed wire-drawing machinery.

Purchase is desired in Marseilles, France (No. 16,195), of electrically driven book-binding plant machinery.

TRANSMISSION LINE MATERIAL, TRANSFORMERS, SWITCHGEAR, ETC., FOR THE WAIKATO (NEW ZEALAND) POWER SCHEME.—Tenders will be received by the Department of Public Works, Wellington, New Zealand, until Sept. 29, for a supply of 110,000-volt transformers for the Waikato electric power scheme (section 122); for construction of 440 suspension, 100 angle and 20 strain galvanized transmission-line towers for the Waikato power scheme (section 124); for a supply of 50,000-volt switchgear and steel work for Waikato electric power scheme, Penrose substation (section 113). Tenders will also be received until Oct. 13 for 3,600 suspension insulator and 300 strain insulator strains (section 123); for 3,600 suspension clamps, 300 strain clamps and 150 parallel grove clamps (section 128).

New Trade Literature

AUTOMATIC CONTROLLERS. — The C. J. Tagliabue Manufacturing Company, 18 Thirty-third Street, Brooklyn, N. Y., is distributing catalog No. 900, covering its "Tag" automatic controllers for temperature, pressure, humidity, time, condensation and liquid level. It calls attention to the importance of automatic control in various industries and contains many illustrations showing applications of its various types of controllers.

POLARITY TRANSFORMERS. — The Pittsburgh Transformer Company, Pittsburgh, Pa., is distributing bulletin No. 2,047 covering the Pittsburgh polarity transformers. It contains illustrations, dimension tables and drawings of the transformers.

CRACKING PROCESS.—"Jenkins Cracking Process" is the title of bulletin No. 101 issued by the Graver Corporation, East Chicago, Ind., in which it describes the principles of the "Jenkins" cracking process for producing a stable quality of gasoline and also instructions for construction and operation of the process. A drawing showing a typical flow sheet is included.

AFTER-COOLERS. — The Pennsylvania Pump & Compressor Company, Easton, Pa., is distributing bulletin No. 122, in which it describes and illustrates the "Pennsylvania" after-coolers, designed for use with compressed air. It contains a table of sizes, capacities and weights of the types "HC" and "VC" after-coolers.

COAL AND ASH-HANDLING EQUIPMENT. — The Link Belt Company, 910 South Michigan Avenue, Chicago, has issued a publication, known as book No. 720, describing the "Peck" carrier for coal, ashes, cement, sand, ore, stone, etc. It contains illustrations showing typical installations of the "Peck" carrier in many public buildings and industrial plants throughout the United States. Data of interest to engineers and architects and to any one interested in boiler houses and their equipment are included.

PUMPS.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, is distributing a bulletin calling attention to the use of the Worthington equipment for power plants.

New Incorporations

THE LAKE SHORE POWER COMPANY, Hamilton, Ind., has been incorporated with a capital stock of $40,000 by Samuel G. Stone, C. W. Campbell and A. L. Gebhard, all of Hamilton. The company proposes to operate electric utilities in this section.

THE CENTRAL CAYUGA ELECTRIC COMPANY, INC., Geneva, N. Y., has been chartered by H. C. Palmer, C. H. Pierce, and Morris Tracy, Geneva, N. Y. The capitalization consists of 2,000 shares of no par value. The company proposes to generate and distribute electricity for lamps, heaters and motors.

THE BETHESDA-NEW HOPE LIGHT & POWER COMPANY, Lowell, N. C., R. F. D. No. 2, has been incorporated with a capital stock of $25,000 by E. Z. Ratchford, Gastonia, R. F. D., and A. M. Sugs, Lowell, R. F. D. No. 2.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BRUNSWICK, ME.—The Androscoggin Water Power Corporation, recently organized by officials of the Pejepscot Paper Company, has taken over the water power properties of the latter company.

BETHLEHEM, N. H.—Work will soon begin by the Bethlehem Electric Company on the construction of a hydro-electric plant on the Ammonusoc River, to cost about $125,000. A transmission line will be built. Contract for dam has been let to the Ambursen Construction Company, Boston.

BOSTON, MASS.—Bids will be received by the Transit Department of the City of Boston, 1 Beacon Street, until Aug. 27, for building Section 1 of the Dorchester Rapid Transit, consisting of road-bed, together with two station platforms and certain equipment, such as conduits, manholes, etc., for a surface railway extension of the third-rail service of the Dorchester Tunnel.

FITCHBURG, MASS.—The installation of an electric police signal system to cost about $44,000, is under consideration by the City Council.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 19 for furnishing chain hoist net wire, X-ray machine and stabilizer, flashlights, insulating tape and electrical supplies, etc., to the Navy Supply Depot, Brooklyn.

BUFFALO, N. Y.—Plans have been filed by the Ralston Purina Mills, Inc., for construction of a mill and warehouse, to cost about $250,000. The present plans provide a power plant.

JAMESTOWN, N. Y.—The installation of an underground conduit system for all overhead wires in the downtown district is under consideration by City Council.

MIDDLETOWN, N. Y. — The Orange County Public Service Company, Inc., has been authoriezd to extend its service to Unionville, Minisink and Wawayanda. It plans to erect a 33,000-volt transmission line from Middletown through the two townships.

NEW YORK, N. Y.—Plans have been filed by the New York, New Haven & Hartford Railroad Company, 466 Lexington Avenue, for a switching station and circuit breaker, near Whitlock Avenue.

PUTNAM VALLEY, N. Y.—Permission has been granted the Carmel (N. Y.) Light & Power Company to extend its service to Putnam Valley and to operate under a franchise granted by the Town Board.

SAVONA, N. Y.—The New York Central Electric Corporation, Perry, which has acquired the municipal electric system, plans extensions and improvements to the system.

SKANEATELES, N. Y.—Plans for the proposed new local factory building of the Seneca Fibre Products Company, Seneca Falls, include a power plant.

AVIS, PA.—Additional equipment will be installed in the power house at the local shops of the New York Central Railroad Company, New York, including apparatus for burning powdered fuel.

DOUGLAS, PA.—The Pittsburgh Coal Company, Oliver Building, Pittsburgh, plans to install electric power equipment in connection with proposed extensions to its properties in the Douglas Hollow section, to cost about $1,500,000.

ERIE, PA.—New equipment being installed by the Erie County Electric Company, include a 12,500-kva. turbo-generator, two Union Iron 625-hp. boilers, two Westinghouse stokers, water and steam piping, spray pond, Elliot condensor, etc. The company is also building a new outdoor 13,800-volt switching station. P. G. Sturtevant is engineer.

HATBORO, PA.—Plans for the proposed local textile mill to be erected by the Oscar Nebel Company, Fifth and Courtland Streets, Philadelphia, at a cost of about $125,000, include a power house. The William Steele & Sons Company, 219 North Broad Street, Philadelphia, is architect and engineer.

LANCASTER, PA.—The Edison Electric Company, which recently purchased the electric plants at Brownstown, Wrightsville and vicinity plans extensions in its transmission lines in that district.

MIQUON, PA.—Plans are being considered by the W. C. Hamilton Paper Company for equipping its local mill for electrical operation to replace the present steam driven machinery. A steam turbo-generator will be purchased.

PHILADELPHIA, PA.—The Philadelphia & Reading Company, Reading Terminal, plans to install electric power equipment in connection with extensions in its ore-handling plant at Pier 14, Port Richmond, to cost about $1,000,000.

PHILADELPHIA, PA.—A large single steam condenser, capable when operating at its maximum capacity to circulate nearly 150,000,000 of water a day has been completed by the Westinghouse Electric & Manufacturing Company, for the new Richmond station of the Philadelphia Electric Company. The plans of the Philadelphia company provide for the ultimate installation of twelve large condensers at this station. To operate the two circulating pumps of the condenser just completed, the company will install two 500-hp. Westinghouse motors.

TOWANDA, PA.—The General Gas & Electric Company, 50 Pine Street, New York City, which has recently acquired the Towanda Gas & Electric Company and the North Penn Power Company, operating in Towanda, North Towanda, Wyso, Monroe, Blossburg, Troy, Galeton and thirteen other communities in Pennsylvania, plans to connect these systems with the lines of the Sayre (Pa.) Electric Company and the Susquehanna County Light & Power Company, already controlled, and to consolidate the Pennsylvania companies into one company.

HARTLAND, W. VA.—The local plant of the Interstate Power Company, Charleston, will be closed down upon the completion of the tie-line of the Appalachian Power Company, which will be connected about Aug. 1.

PRINCETON, W. VA. — The Virginian Brick Company has acquired a local site, on which it proposes to build new works, which will include a power plant and machine shop.

SOUTH BOSTON, VA.—Plans are under way by the Southside Virginia Power Company for the construction of a hydro-electric plant on Meherrin, Dan or Staun-

ton Rivers. Ira Vaughan, 240 Susquehanna Street, Philadelphia, is reported interested in the project.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, until August 26, for equipment for power station at the local Naval Hospital, including coal receiving hopper, reciprocating feeder, coal crusher, bucket elevator, etc. (Specification 5130).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Washington, until August 20, for 3,000 lead type storage batteries, etc. (Proposal CP. 21718-1).

WASHINGTON, D. C.—Bids will be received by the Office of Public Buildings and Parks, Washington, until August 19, for one 400-kw. unaflow engine-generator set, for the State, War and Navy Building.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until August 20, for a quantity of electrical supplies for various yards (Schedule 4145).

North Central States

MANCHESTER, MICH.—An election will be held on Aug. 31 to vote on the proposal to sell the municipal electric plant to the Consumers Power Company, Jackson. Extension to the system is contemplated.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Aug. 21 for furnishing material and erecting an addition to the municipal electric plant.

CLEVELAND, OHIO.—Plans are being prepared by the Ohio Public Service Company for the first unit of a steam-driven electric power plant to be built at Dilles. George E. Snider is chief engineer.

STEUBENVILLE, OHIO.—Plans for the proposed local plant of the Hollow Rock Mining & Transportation Company, operated by the Crescent Brick Company, New Cumberland, W. Va., for the manufacture of sewer pipe, to cost about $300,000, include a power house.

BEDFORD, IND.—Bids, it is reported, will soon be asked by the City Council for equipment for two pumping stations for the municipal waterworks, consisting of two pumps, one 2,500,000-gallon and one 2,000,000-gallon per day capacity, both electrically operated.

CHICAGO, ILL.—Electric power equipment will be installed in the laundry building to be erected at 829 Franklin Street by the American Linen Supply Company, 140 West Austin Avenue, to cost about $540,000.

PANAMA, ILL.—The Cosgrove-Meehan Coal Company plans to build a steam-operated electric plant at its local properties, to cost about $125,000.

ROCKFORD, ILL.—The erection of a new cable line from Rockland to Highland and installing 200 new telephones, to cost about $100,000, is under consideration by the Illinois Bell Telephone Company, Springfield.

SANDWICH, ILL.—Improvements to the street-lighting system are contemplated by the Illinois Northern Utilities Company, Dixon.

CEDARBURG, WIS. — Plans have been adopted by the City Council for extensions to the municipal electric plant, to cost about $50,000. The work will include the installation of a 450-hp. Diesel engine to replace the present steam equipment.

STEVENS POINT, WIS.—The Wisconsin Valley Electric Company, Wausau, plans to erect a transmission line to High Banks to furnish service there.

DULUTH, MINN.—Plans have been prepared by the Minnesota Power & Light & Power Company for the construction of four substations at Lakeside in East End, next to the present station at Fifteenth Avenue and Sixty-seventh Avenue West, to cost about $300,000.

MILACA, MINN.—The Eastern Minnesota Power Company, Pine City, Minn., it is reported, will soon ask for bids for the erection of a steam-operated electric plant in Milaca, to cost about $100,000, including transmission line. R. B. Fanning, Kasota Building, Minneapolis, is engineer.

ANKENY, IOWA.—The local station and transformer building of the Fort Dodge, Des Moines & Southern Railroad Company, Boone, was recently destroyed by fire, causing a loss of about $40,000.

MOVILLE, IOWA.—Th Northville Light & Power Company, which recently acquired the electric plants in Bronson, Lawton and Correctionville, is negotiating for the municipal electric plant. The company has acquired a franchise for the erection of a high-tension transmission line extending from Correctionville to Moville, Lawton and Bronson. It has also filed a petition for permission to build another line.

HEMPLE, MO.—Plans are under way by the Hemple Electric Light & Power Company, recently organized, for the erection of a transmission line, substation and distributing system. B. A. Boyer, Hemple, is interested in the company.

JOPLIN, MO. — The Wilhoit Refining Company plans to build a power plant in connection with proposed extensions and improvements in its local oil refinery, to cost about $150,000.

ST. LOUIS, MO.—Bids will soon be asked by the City Council for annual requirements of incandescent lamps for municipal use.

WASHBURN, N. D. — Application has been made by the Central Light & Power Company to the State Railway Commission for permission to erect a transmission line from Garrison to Garrison Corners, with substation.

RAPID CITY, S. D.—Bids will be received by the Boards of Regents of Education of the State, at the office of C. C. O'Harra, president of the State School of Mines, until Sept. 1, for an underground electrical cable system on the campus. J. O. Kammerman, professor of electrical engineering, is in charge of the work.

KEARNEY, NEB.—A petition asking that the City Council take steps to establish a municipal electric light plant has been filed.

KANSAS CITY, KAN.—The Municipal Light and Power Department has retained Arthur L. Mullergren, consulting engineer, Gates Building, Kansas City, Mo., to prepare plans for a complete new boiler plant, consisting of a new building, equipped with boilers of 3,000 hp. capacity, coal and ash-handling equipment, steam piping, etc. The cost is estimated at $700,000.

Southern States

ELLENBORO, N. C. — The Ellenboro Manufacturing Company, recently organized, plans to build a steam-operated electric plant in connection with its proposed local textile mill.

RALEIGH, N. C.—Bids will be received by E. E. Culbreth, Mayor, and City Commissioners, until Aug. 6 for two motor-driven centrifugal pumping units and starting compensators, etc. W. C. Olsen, Raleigh, is engineer.

CLOVER, S. C.—The Southern Public Utilities Company, Charlotte, is negotiating for the purchase of the municipal electric light plant.

BABSON PARK, FLA. — The Florida Highlands Light & Water Company, recently organized, is considering the installation of a local lighting system.

GROVELAND, FLA.—The Council has awarded a contract to the Florida Public Service Company, Orlando, for the installation of an ornamental lighting system in the downtown district.

MELBOURNE, FLA. — The installation of an ornamental lighting system in the business section is under consideration by the Council.

PLANT CITY, FLA.—An election will be held on Sept. 1 to vote on the proposal to issue $25,000 in bonds for the installation of an ornamental lighting system in the business section.

POMPANO, FLA.—The installation of an ornamental lighting system in Pompano Terrace subdivision is under consideration by A. J. Speck.

KNOXVILLE, TENN.—Plans are being prepared for improvements to the waterworks, including a new pumping station, a 15,000,000-gal. filtration plant and storage reservoir, to cost about $1,500,000. Alvord, Burdick & House, Hartford Building, Chicago, are engineers.

LENOIR CITY, TENN.—The Lenoir Car Works, Inc. plans to install electric power equipment in connection with the rebuilding of its railroad car manufacturing plant, recently damaged with loss of about $400,000.

MORRISTOWN, TENN.—Plans are under consideration by E. G. Price and associates for the erection of a transmission line and substation for local service.

BIRMINGHAM, ALA. — Plans for the proposed lumber mill to be erected by the Birmingham Sash & Door Company, near the Birmingham terminal, include a power plant.

HUNTSVILLE, ALA.—Extension to the ornamental lighting system is under consideration by the Alabama Power Company, Birmingham.

PASCAGOULA, MISS.—The Mississippi Power Company, Gulfport, is negotiating for the purchase of the municipal electric plant.

STUTTGART, ARK. — The Arkansas Light & Power Company, Pine Bluff, plans to install electric power equipment in connection with proposed extensions in its local ice-manufacturing plant, to cost about $60,000.

MER ROUGE, LA.—The local lighting plant was recently destroyed by fire, causing a loss of about $12,000.

MORGAN CITY, LA. — The Louisiana Public Utilities, Inc., New Iberia, which recently acquired the electric and ice plant of the Morgan City Electric Company, contemplates extensions and improvements to the system.

CASTLE, OKLA.—The Oklahoma Power Company, Okmulgee, plans to build a distributing system here with substation for local service.

HINTON, OKLA. — The City Council plans to call an election to vote on the proposal to issue $25,000 in bonds for the installation of an improved lighting system. The Benham Engineering Company, Gumbel Building, Kansas City, Mo., is engineer.

SHADY POINT, OKLA.—Mixon & Phillips plan to build an electric power plant in connection with the rebuilding of their cotton gin, recently damaged by fire.

EL CAMPO, TEX.—Plans are under consideration by the El Camp Electric & Ice Company for extensions and improvements in its system, to cost about $85,000.

IDABEL, OKLA.—Bids will be received by W. O. Campbell, City Clerk, until Aug. 18 for one 500,000-gallon per day pump, rapid sand filter plant, pumping equipment, 100-hp. oil engine, transmission line, etc. The cost is estimated at $50,000. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

ARCHER, TEX.—The local electric plant has been acquired by the Wichita Falls (Tex.) Electric Company.

GREENVILLE, TEX.—Bids will be received by J. O. Wellman, City Secretary, until Aug. 24 for extensions to waterworks, including reservoir, filtration plant, one 20,000-gallon per minute pump, etc. H. Rush, is engineer.

NEW BRAUNFELS, TEX.—The Comal Power Company is negotiating for the purchase of the hydro-electric plant of the Landa Electric Light & Power Company, and power site for a proposed hydro-electric power development, to cost about $1,500,000.

Pacific and Mountain States

KALAMA, WASH.—The installation of an ornamental lighting system on Main Street, using concrete standards is under consideration by the Business Men's Club. J. G. Gruver is president.

KELSO, WASH. — A permit has been granted to the Puget Sound Power & Light Company, Seattle, to build a substation at Fifth and Vine Streets.

TACOMA, WASH.—Bids, it is understood, will soon be asked by the Municipal Light Department for construction of a diversion dam (second unit) for the Cushman power project, to cost about $100,000.

ST. HELENS, ORE. — The St. Helens Pulp & Paper Company, recently organized by W. P. Hawley, of the Hawley Pulp & Paper Company, Oregon City, and associates, plans to build a power plant at its proposed local mill. The cost of the project is estimated at $1,000,000.

BAKERSFIELD, CAL.—The City Council is planning to install ornamental lamps in Street District 514, using metal standards.

BERKELEY, CAL.—The City Council is considering the installation of ornamental lamps on Kittredge Street.

COTTONWOOD, CAL.—Plans are being prepared by the Pacific Gas & Electric Company, San Francisco, to build a local substation, to cost about $460,000.

CULVER CITY, CAL.—The installation of ornamental lamps on Washington Boulevard, from the city limits to First Street is under consideration by the Council.

ESCONDIDO, CAL. — Plans are under consideration by the City Council for the installation of ornamental lamps on Grand Avenue, Lime and Kalmia Streets, totaling about ninety standards.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has applied for permission to use water from ten different sources in Fresno County for a proposed hydro-electric project, with main station on the North Fork of the Kings River, to develop a maximum of 60,750 hp.

LOS ANGELES, CAL.—The City Council is considering the installation of ornamental lamps on Ridgewood Place, from Elmwood Avenue to Wilton Drive, using pressed steel standards.

LOS ANGELES, CAL. — The Richfield Oil Company, Bartlett Building, plans to install electric power equipment in connection with extensions and improvements in its properties, to cost about $5,000,000.

OAKLAND, CAL.—The City Council is considering an appropriation of $170,000 for a central fire-alarm station. W. W. Harmon is city engineer.

RICHMOND, CAL.—Plans are under consideration for the installation of ornamental lamps on Tenth, Ninth, Eighth, Seventh and Sixth Street, between Macdonald and Nevin Avenues. E. A. Hoffman is city engineer.

SAN DIEGO, CAL.—The City Council is considering the installation of ornamental lamps on University and Cleveland Avenues, Fourth and Fifth Streets.

SOUTH PASADENA, CAL.—The Board of Trustees have authorized the installation of ornamental lamps (34) on Mila Avenue.

VENICE, CAL.—The City Council is considering calling an election to submit the proposal to issue $165,000 in bonds for fire and police-alarm systems.

PHOENIX, ARIZ.—Arrangements have been made by the Salt River Valley Water Users' Association for the construction of the first of two 10,000-hp. hydro-electric units at the Mormon Flat Dam on Salt River. The output of this plant will be sold to the Central Arizona Light & Power Company, which contemplates an expenditure of about $200,000 in Phoenix to enable it to distribute the additional power here.

TUCSON, ARIZ.—Plans are under consideration by the Ivey-Dale-Owen Company to establish a power plant to cost about $100,000, for the purpose of irrigating a large tract of land, near Continental.

FORT COLLINS, COL. — The Colorado Portland Cement Company has awarded a contract to the Traylor Engineering Company, Allentown, Pa., for the construction of a cement plant in Fort Collins. The present plans include a power plant.

Canada

COTTOM, ONT. — The Hydro-Electric Power Commission of Ontario Toronto, contemplates the erection of a transmission line from Cottom to Essex, to cost about $30,000.

GALETTA, ONT.—Plans are under way for the development of Chat Falls on the Ottawa River, about 32 miles above Ottawa. The power development is being jointly undertaken by the Ontario Hydro-Electric Power Commission, the Kingdon Mining, Smelting & Manufacturing Company, and the James Robertson Company. The plans provide for an ultimate development of 120,000 hp., one-half of which would go to Ontario Commission and the other to the latter companies. Of the 60,000 hp. belonging to the latter interests at first only 28,000-hp. will be developed in two units of 14,000 hp. each. The hydro plant will be erected on the Ontario side of the falls and the latter plant on the Quebec side.

ABBOTSFORD, QUE.—Bids, it is understood, will soon be asked by the Southern Canada Power Company, Ltd., Montreal, for the erection of electric lines in Abbotsford, to cost about $30,000.

HULL, QUE.—Bids, it is reported, will soon be asked by the Ottawa-Montreal Power Company, Ltd., for the erection of transmission lines at St Lazare, to cost $25,000, and Hudson, $30,000.

QUEBEC, QUE.—The installation of a fire-alarm telegraph system to cost about $228,000, is under consideration by the City Council. F. C. Laberge, 30 St. James Street, Montreal, is city engineer.

WINDSOR MILLS, QUE.—An additional water power site, capable of developing 12,000 hp., has been acquired by the Canada Paper Company, Ltd. Plans have been prepared for the proposed development of this site, work on which will be carried out as soon as extension to the paper mill is completed.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 14, 1925)

1,545,523. MEANS FOR TRANSMITTING TIME SIGNALS; H. Riegger, Pankow, near Berlin, Germany. App. filed Nov. 18, 1924.

1,545,525. EAR TELEPHONE; H. Sell, Berlin-Charlottenburg, Germany. App. filed Dec. 14, 1922. For persons with defective hearing.

1,545,534. ELECTRICALLY HEATING BAKING OVENS AND THE LIKE; R. G. Tungendhat, Saginaw, Mich. App. filed Aug. 1, 1924.

1,545,541. TANDEM OPERATED ECHO SUPPRESSOR; S. B. Wright, East Orange, N. J. App. filed July 2, 1924. For transmission circuits.

1,545,549. TANDEM OPERATED ECHO SUPPRESSOR; B. L. Child, Brooklyn, N. Y. App. filed July 2, 1924. For transmission circuits.

1,545,550. ELECTRIC FUSE; F. Coates, Cleadon, England. App. filed April 16, 1925. For use in high voltage circuits.

1,545,558. TANDEM OPERATED ECHO SUPPRESSOR; H. S. Hamilton, New York, N. Y. App. filed July 2, 1924. For transmission circuits.

1,545,561. ELECTRODEPOSITION OF METALS; T. W. Hutchins, Northwich, England. App. filed Sept. 2, 1924.

1,545,562. LIGHTING FIXTURE; J. L. Jaffe, Cleveland, Ohio. App. filed July 10, 1923.

1,545,572. TROLLEY DEVICE; S. Pulvery, McKees Rocks, Pa. App. filed June 21, 1922. Trolley wheels and wheel-retaining device.

1,545,579. ELECTRIC SWITCH; J. Bradley, Brooklyn, N. Y. App. filed Dec. 28, 1923. Circuit made and broken through a liquid contact.

1,545,582. PROCESS OF AND APPARATUS FOR THE REDUCTION OF ORES; B. G. Cobb, Toronto, Ontario, Canada. App. filed July 17, 1920. By the passage of an electric current through the ore while in a fluid state.

1,545,581. PRINTING TELEGRAPHY; M. P. Chaplin, White Plains, N. Y. App. filed Nov. 16, 1920. Receiving apparatus.

1,545,585. EXTENSIBLE CABLE DEVICE; H. Koch, Jamaica, N. Y. App. filed June 17, 1921. For automatically taking up slack in cables.

1,545,591. MANUFACTURE OF ELECTRON DISCHARGE DEVICES; J. J. Madine, Newark, N. J. App. filed March 6, 1923. To obtain a right seal between the leading-in wires and the glass envelope.

1,545,599. METHOD OF AND MEANS FOR PRODUCING OSCILLATING CURRENTS OF HIGH FREQUENCY; P. O. Pedersen, Fredericksburg, Denmark. App. filed March 22, 1921.

1,545,601, 1,545,602. TELEGRAPH SYSTEM; L. M. Potts, Highwood, N. J. App. filed Dec. 18, 1922.

1,545,606. SIGNAL; H. W. Ryder, Cicero, Ill. App. filed Dec. 28, 1923. Used in telephone systems.

1,545,607. SYSTEM OF WAVE DISTRIBUTION; J. C. Schelleng, East Orange, N. J. App. filed Dec. 22, 1920. Oscillator circuit arrangement for supplying variable current at constant frequency.

1,545,614. SWITCH HOUSING STRUCTURE; W. M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Feb. 4, 1922. For housing electric switches, automatic circuit breakers, etc.

1,545,627. CABLE SUPPORT; F. H. Wohlers, Jamaica, N. Y. App. filed Oct. 2, 1920. For supporting and automatically taking up slack in cables that connect portable devices.

1,545,654. WATER COOLED ANODE FOR VACUUM TUBES; A. H. Hoppock, Westfield, N. J. App. filed Nov. 20, 1920.

1,545,672. STATIC DISCHARGER FOR AUTOMOBILE TRUCKS; C. D. McArthur, Pittsburgh, Pa. App. filed Dec. 11, 1924.

1,545,673. DAMPER WINDING; R. A. McCarty, Wilkinsburg, Pa. App. filed Nov. 5, 1923. For salient-pole, alternating-current machines.

1,545,685. FUSE; E. L. Ogle, Chicago, Ill. App. filed Aug. 29, 1921. For use in multiphase circuits, which is adapted, upon an overload and resultant opening of the circuit of one phase, to open the circuit of the other phase or phases.

1,545,697. ELECTROMAGNETIC WAVE RECEIVING SYSTEM; O. C. Roos, Boston, Mass. App. filed Nov. 4, 1921.

1,545,699. CURRENT COLLECTOR FOR VEHICLES; W. Schaake, Pittsburgh, Pa. App. filed Nov. 2, 1921. For trackless trolleys.

1,545,705. ALLOY AND METHOD OF MAKING AND CASTING SAME; W. H. Smith, East Cleveland, Ohio, and C. M. Campbell, Cleveland, Ohio. App. filed Aug. 22, 1921. Using an electric furnace.

1,545,708. TRANSMISSION OF PICTURES BY ELECTRICITY; D. M. Terry, New York, N. Y. App. filed May 8, 1924. Means for controlling the reproducing process.

1,545,718. AMPLIFYING MICROPHONE RECEIVER; C. E. Williams, Chicago, Ill. App. filed March 5, 1923.

1,545,724. WAVE SIGNALING SYSTEM; E. H. Armstrong, Yonkers, N. Y. App. filed June 8, 1922. Regenerative system for amplifying varying electric currents.

1,545,728. TIME CONTROLLED ELECTRIC SWITCH SYSTEM; C. H. Beck, San Francisco, Cal. App. filed Dec. 31, 1923.

1,545,733. DAMPER WINDING SUPPORT; C. C. Brinton, Edgewood, Pa. App. filed July 1, 1924. For polyphase synchronous machines.

1,545,735. TROLLEY BASE; L. F. Burnham, Fairport, N. Y. App. filed May 24, 1921.

1,545,754. CIRCUIT INTERRUPTER; L. R. Golladay, Wilkinsburg, Pa. App. filed June 22, 1922. For alternating-current circuits, or in connection with direct-current circuits wherein the direction of current flow is sometimes reversed.

1,545,767. ELECTRIC FUSE; W. J. Hawkins, Montclair, N. J. App. filed Feb. 25, 1920. Renewable.

1,545,776. AMMETER; W. Kaisling, Chicago, Ill. App. filed Dec. 28, 1918. Small type.

1,545,781. RENEWABLE FUSE PLUG; F. M. Long, Porto Alegre, Brazil. App. filed May 16, 1922.

1,545,785. MULTIPLE-BREAK CIRCUIT INTERRUPTER; J. N. Mahoney, Brooklyn, N. Y. App. filed Feb. 16, 1921. Oil-immersed switches adapted to control circuits of relatively high potential and current.

1,545,828. TRANSMITTER; R. R. Herrmann, St. Paul, Minn. App. filed Jan. 24, 1922. Telephone transmitter of the multicellular type.

1,545,852. ELECTRIC GLUEPOT; E. J. Rohne, Minneapolis, Minn. App. filed Aug. 24, 1923.

1,545,855. AMPLIFIER CIRCUITS; E. O. Scriven, New York, N. Y. App. filed July 29, 1924.

1,545,858. HEATER; V. Smith, Portland, Ore. App. filed May 12, 1924. For warming beds, etc.

1,545,868. CONTROLLING MEANS FOR ELECTRIC MOTORS; F. G. Warburton, London, England. App. filed Dec. 29, 1919. Of electrically driven paper machines and other sectional machinery.

1,545,880. TELEPHONE EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed April 20, 1907. Semi-automatic.

1,545,886. METHOD AND APPARATUS FOR ESTABLISHING HIGH-VOLTAGE ELECTRIC CIRCUITS, COMPRISING REMOVABLE HAND CONTACT-MAKING DEVICES; App. filed Jan. 17, 1923.

1,545,920. MAGNET TELEPHONE; O. Oelze, Kiel, Germany. App. filed Dec. 10, 1924.

1,545,940. ELECTROMAGNETIC WAVE RECEIVING SYSTEM; S. Cabot, Brookline, Mass. App. filed May 25, 1922. For controlling the oscillatory phenomena in systems of the radio-frequency amplifier type.

1,545,941. ART OF ELECTROPLATING; E. A. Coady, New York, N. Y., and F. W. Olmstead, Hempstead, N. Y. App. filed Dec. 11, 1924. Brush for electrolytically applying metals, such as nickel, to conducting surfaces.

1,545,942. ELECTROPLATING; F. Conlin, Westfield, N. J. App. filed Jan. 12, 1925. Brush for electrolytically applying metals, such as nickel, to conducting surfaces.

1,545,954. CIGAR LIGHTER; P. J. Fischer, Chicago, Ill. App. filed Oct. 5, 1920.

1,546,046. COMBINED CURLING AND WAVING IRON; N. D. Thompson, Jr., St. Louis, Mo. App. filed Aug. 9, 1924.

1,546,061. PROCESS OF HEATING LIQUIDS; L. C. Drefahl, Lakewood, Ohio. App. filed Nov. 23, 1923. Direct application of electrically generated heat to liquids which are non-conductors or poor conductors of electricity.

1,546,068. PROCESS OF WELDING ROTOR BARS; K. L. Hansen and W. J. Oesterlein, Milwaukee, Wis. App. filed Jan. 2, 1925.

1,546,070. ELECTRIC SYNCHROSCOPE AND SYNCHRONIZING APPARATUS; P. F. Harris, South Shields, England. App. filed April 16, 1925.

1,546,078, 1,546,079. BATTERY HANDLAMP; H. Hyman, Brooklyn, N. Y. App. filed Oct. 6, 1923.

1,546,083. CAR HEATING SYSTEM; J. M. King, Danville, Va. App. filed Feb. 5, 1925.

Financial and Corporate

Utility Market Stronger

United Light & Power Is Leader in the Unlisted Advance as Trading Improves

THE outstanding event of the week affecting the securities markets was the reduction in the discount rate of the Bank of England from 5 to 4½ per cent. In this act traders read what they interpreted as a sign of continued easy money on this side of the water. It was thought that England would not have reduced her rate if, after consulting with our authorities, she had expected much dearer rates here in the near future. To have done so would have threatened a diminution of her gold supplies. Consequently the British action has aided the markets here in general, and the power and light issues have profited along with other stocks.

On the big board a spectacular advance was scored by Montana Power, that stock having moved, on various rumors not confirmed, to 99¼ for a new high at one time. It closed the week ten points above where it was a week ago. Havana Electric likewise rose to a new high on a revival of rumors of a purchase of control at a figure well above 200, the stock gaining five points on the week and selling as high at one time as 197½. While no new high was made by the North American Company's shares this week, trading continued active and the stock again under persistent and heavy accumulation rose to a level fractionally above 60. Virginia Railway & Power was another star performer on the big board, that listed issue having moved forward fifteen points and setting a new top at 135½.

United Light & Power was the leader of the unlisted market on the rumor, not denied at the company's office, that another important announcement is soon to be made which will reveal that United has come into control of another important group of properties. The stock rose to 136 at one time and closed the week nine points up. American Light & Traction rose above 200. Southern Cities gained over seven points and Middle West Utilities continued active.

New Capital Issues

During the past week the Laclede Gas Light Company floated a new issue of ten-year 5½ per cent gold notes totaling $3,000,000, the price being 98½ and accrued interest, to yield about 5.70 per cent. These notes are to be direct obligations of the company, and the proceeds are to be used to reimburse it for additions and betterments made and to provide funds for further capital expenditures.

Also represented in the week's financing was the Consolidated Power & Light Company of South Dakota with an issue of one-year mortgage lien 6 per cent gold notes amounting to $1,900,000. The notes were offered at 100 and accrued interest, yielding 6 per cent. Proceeds derived from the sale of these mortgage lien notes will be used for the retirement of outstanding notes of the company presently maturing and partly to reimburse the treasury for funds advanced for the acquisition of additional properties.

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Associated Gas & El., $6 div. ser pf.	$1.50	Sept. 1
Blackstone Val. Gas & El., com.	$1.25	Sept. 1
Central Arkansas Ry. & Lt., pf.	1¾	Sept. 1
Central Mississippi Valley Elec. Prop., pf.	$1.50	Sept. 1
Federal Light & Traction, com.	.20	Oct. 1
Federal Light & Traction, com.*	.15	Oct. 1
Federal Light & Traction, pf.	1½	Sept. 1
Georgia Railway & Power, com.	$1	Sept. 1
Middle West Utilities, pf.	1¾	Oct. 15
Portland Electric Power, 2d pf.	1½	Sept. 1
United Electric Light, pf.	1¾	Aug. 15
United Electric Light, com.	2	Aug. 15
Radio Corp. of America, pf.	1¾	Oct. 1
Timken Roller Bearing	.75	Sept. 5
Timken Roller Bearing, extra	.25	Sept. 5

*Payable in common stock.

Company Reports

The following statements of earnings were issued during the past week by electric light and power companies for the month of June:

Name of Company	Gross Earnings for June 1925	1924
Asheville Power & Light	$97,027	$84,375
Carolina Power & Light	252,825	194,840
Cities Service	1,858,430	1,649,962
Eastern Shore Gas & Electric	70,975	47,874
Grafton County Electric Lt. & Power	16,899	15,679
Havana Elec. Ry., Lt. & Pwr.	1,241,402	1,158,386
Manchester Trac., Lt. & Pwr.	193,862	196,992
Penna. Central Lt. & Pwr.	319,669	286,460
Yadkin River Power	153,754	144,275

Foreign Securities Sold in United States

The following tabulation covers foreign electric light and power and electrical manufacturing securities sold in the United States during 1925:

Issues	Amount	Price	Yield
German Gen. El., 7's, 1945	$10,000,000	93½	7.70
Siemens & Halske, 7's, 1928	10,000,000	99	7.37
7's, 1935		96½	7.64
Saxon Public Works, Inc., 7's, 1945	15,000,000	92	7.80
Toho Elec. Pwr., Ltd., 7's "A", 1955 (Japan)	15,000,000	90½	7.80
Elec. Pwr. Corp.(Germany) 6½'s, 1950	5,000,000	87	7.67
Ujigawa Elec. Pwr. Ltd., 7's, 1945 (Japan)	14,000,000	91	7.90
Tyrol Hydro-Elec. Pwr., 7½'s, 1955 (Austria)	3,000,000	96½	7.80
Gt. Cons. Elec. Pwr., Ltd., 6½'s, 1950, (Japan)	13,500,000	86	7.75
Tokyo Elec. Lt, 6's, 1928 (notes) (Japan)	24,000,000	98½	6.40
Total	$109,500,000		

Associated Gas & Electric Directors Meet

The Associated Gas & Electric Company board of directors met last week for the purpose of acting upon the dividend upon the $6 dividend series preferred stock. In line with the previous action on this stock, the option was given the stockholders of receiving, in lieu of the $1.50 quarterly cash dividend payment, four and one-half hundredths of a share of class A stock, which, at a market price of $40 per share, amounts to $1.80, or at the rate of $7.20 per annum. The directors also discussed the proposed offering of subscription rights to all classes of stockholders, both preferred and class A and holders of other securities having the right to convert their securities into preferred stocks. It was decided that this offering will be to stockholders of record August 10. The precise form of the offering was not given out, being held under advisement for discussion between the board of directors and the company's counsel. The Associated, which has acquired two-thirds of the outstanding stock of the Manila Electric Corporation, has offered to exchange, at the request of minority holders, Manila Electric common stock, share for share, for Associated class A stock. Application has been made for listing class A stock on the New York Stock Exchange.

To Call Stock.—The American Water Works & Electric Company, Inc., has called for redemption August 24 at 105 and dividends all of its outstanding 6 per cent participating preferred stock.

Southeastern to Split Stock.—Announcement was made on Wednesday that the Southeastern Power & Light Company would split up its common stock on the basis of five shares for one. For this purpose the directors have called a meeting of the shareholders to increase the authorized issue of present no par common and to authorize the issuance of shares of common stock on the basis mentioned. The Southeastern directors are planning to convert, par for par, the outstanding bonds of the Alabama Traction, Light & Power Company, Ltd., the assets of which were assumed last year, into an equal amount of a new issue of 6 per cent debenture bonds of the Southeastern. The new issue of debentures, amounting to $10,000,000, has been sold to Bonbright & Company, Inc., who will offer them at 96½.

General Gas & Electric Incorporated.—The General Gas & Electric Corporation was incorporated in Delaware on July 21 in accordance with the plan outlined in the July 4 issue of the ELEC-

TRICAL WORLD. All of the outstanding 7 per cent sinking fund gold bonds, series A, of the General Gas & Electric Corporation, dated September 1, 1922, and amounting to $3,437,550, have been called for payment September 1 at 105 and interest. All of the outstanding 6 per cent ten-year secured gold bonds, dated September 1, 1919, and amounting to $2,020,200, have been called for payment September 1 at 100 and interest.

Carolina Power & Light's Unusual Place

This Member of the Electric Bond & Share Group Is One of the Few Utilities in America That Are Both Operating and Holding Companies

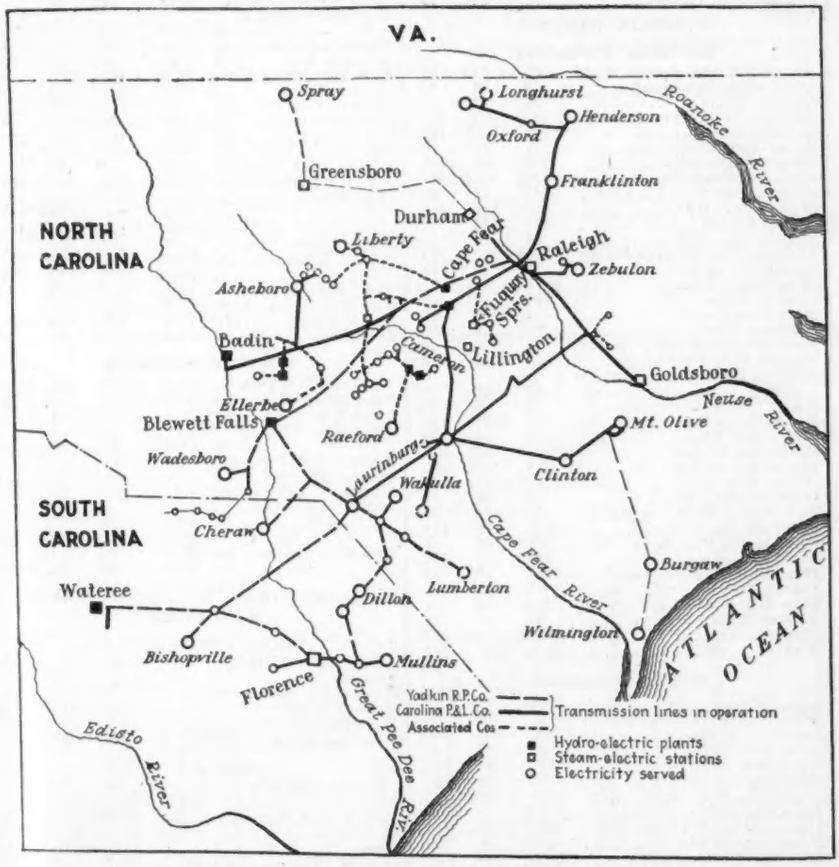
BY PAUL WILLARD GARRETT

THE spectacular move of the Carolina Power & Light Company's stock to about $430 a share this year from a 1925 low of $290 and a 1924 and 1923 low far under these levels has called the attention of many investors in public utility issues to the peculiar position of this company. The Carolina Power & Light Company is one of the few important members of the Electric Bond & Share group that are both operating and holding companies.

As an operating utility the Carolina Power & Light Company supplies through properties owned or leased the entire electric power and light, street-railway and gas service in Raleigh, the gas service in Durham, the electric power and light service in Goldsboro, Henderson, Oxford, Sanford, Dunn, Mount Olive, Clinton, Franklinton, Jonesboro and Roxboro and supplies service to more than fifty other communities, containing a population close to 175,000.

As a holding company the Carolina Power & Light reaches into other communities as owner of the entire common stock, except directors' shares, of the Yadkin River Power Company and the Asheville Power & Light Company. The Yadkin property serves a population of about 80,000 partly in North Carolina and partly in South Carolina. The Asheville Power & Light Company does an electric light and power business and the entire gas and street-railway business in Asheville, N. C., and suburbs, serving a population of 32,000.

In the 1924 annual report recently published President B. S. Jerman said: "Among the important additions to property made during the year was an additional 15,000-kw. steam turbo-generator, together with boilers and auxiliary machinery, in the new Cape Fear generating station near Moncure, N. C. This station is designed and particularly built for an ultimate capacity of 60,000 kw. The initial installation of a 15,000-kw. turbo-generator was placed in operation in the latter part of December, 1923, and the second 15,000-kw. unit was placed in operation last November. This plant now forms a very important part of the physical property of your company. During the year the company added, either by new construction or by purchase of additional properties or by lease, an aggregate of 381 miles of high-voltage transmission lines and 281 miles of electric distribution system." The electric systems of the Carolina Power & Light and the Yadkin River Power companies are interconnected.



TRANSMISSION SYSTEM OF CAROLINA POWER & LIGHT COMPANY

The consolidated gross earnings of the system, tabulated after the elimination of intercompany charges, have risen persistently from $3,604,958 in 1921 to $5,425,014 in 1924 and the net earnings from operations in the same period from $1,474,279 to $2,379,369. Electric power and light operations in 1924 contributed roughly 80 per cent of the entire gross revenues, street-railway operations 11 per cent and manufactured gas 9.

The consolidated balance sheet of the Carolina Power & Light system shows plant and investments on the asset side as $32,182,537 and total assets of $36,605,509. One of the reasons that the Carolina Power & Light Company's stock has enjoyed so pronounced an advance in the market is that it is closely held, but another reason is that the company has a conservative capital structure. A relatively small amount of stock controls an important situation. In the course of time it is expected that a division of the present shares will be made. Capital stock shown on the consolidated balance sheet aggregates $13,542,779 of no-par stock. This includes, of course, the preferred issues of the Carolina Power & Light Company, the Yadkin River Power Company and the Asheville Power & Light Company.

Rochester Gas & Electric to Reclassify Stock. — Stockholders of the Rochester Gas & Electric Corporation voted on July 24 to reclassify and increase the capital stock. The plan provides (a) for an increase in capital stock from $18,250,000 (100,000 shares of preferred stock and 82,500 shares of common stock, both having a par value of $100) to $38,250,000, the additional stock to consist of 200,000 shares of preferred stock; (b) that the additional stock of 200,000 preferred shares (par $100) shall be issued in series, the stock of each series to be entitled to such dividends not in excess of 6 per cent per annum, payable quarterly, and to be subject to redemption at such price not to exceed 105 per cent of the par value thereof as the directors may at the time of authorizing the issue of the particular series fix and specify; (c) for the reclassification of the outstanding issue of 30,000 shares of 5 per cent cumulative preferred stock (par $100) into 30,000 shares of 6 per cent cumulative preferred stock (par $100), to be subject to redemption in whole or in part at 105 on any quarterly dividend payment date; (d) for the changing of the authorized issue of common stock, consisting of 82,500 shares, into 825,000 shares of common stock of no par value.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, Aug. 8	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Pwr. & Lt.—7%	100	98	106
Adirondack Pwr. & Lt.—8%	108	103	115
Appalachian Pwr.—7%	98	92	100
Appalachian Pwr. 1st pf.—7%	100	95	101
Arizona Pwr.—7%	79	75	87
Arkansas Lt. & Pwr.—7%	98	92	102
Asheville Pwr. & Lt.—7%	f101½	101	102½
Central Ill. Pub. Serv.—6%	85	84	93
Cleveland Elec. Illg.—6%	102	101	105
Colo. Pwr.—7%	95	93	98
Conn. Lt & Pwr.—8%	115	115	118
Conn. Lt. & Pwr. —7%	106	105	110
eCon. Gas, El. Lt. & Pwr.—6½%	110	105	110¼
Cons. Gas, El. Lt. & Pwr.—8%	124	123	126
Cons. Gas, El. Lt. & Pwr.—7%	109	108	112
Consumers' Pwr.—6%	94½	90	97
Dayton Pwr. & Lt.—6%	93	88	100
Dubuque Elec.—6%	90	80	90
Duquesne Lt.—7%	110¼	105	111¾
East. Tex. Elec.—6%	100	100	105
Empire Dist. Elec.—6%	78	78	85
Ft. Worth Pwr. & Lt.—7%	f102	101½	103
Georgia Ry. & Pwr.—4%	96	62	90
Gt. West. Pwr.—7%	100	....	....
Ia. Ry. & Lt.—7%	97	92	100
Ill. North. Utilities—6%	88	82	92
Ill. Pwr. & Lt.—7%	95½	92½	98
Interstate Pub. Serv.—7%	97	90	100
Kans. Gas & Elec.—7%	f102	101½	102½
Long Island Lighting—7%	103	100	105
Los Angeles Gas & Elec.—6%	95	90	97
Milwaukee Elec. Ry. & Lt.—8%	100	98	105
Milwaukee Elec. Ry. & Lt.—7%	97½	96	105
Milwaukee Elec. Ry. & Lt.—6%	87	83½	87
Minn. Pwr. & Lt.—7%	f100	100	101
Miss. River Pwr.—6%	92	87½	94
Nebraska Pwr.—7%	f102½	102	103½
N. J. Pwr. & Lt.—7%	102	92	102
New Orleans Pub. Serv.—7%	99	94	102
N. Y. Central Elec.—7%	99	96	101
Niagara Falls Pwr.—7%—25	28	28	29
Niagara, Lock. & Ont. Pwr.—7%	107	101½	110
No. Caro. Pub. Serv.—$7—no par	91	90	96
No. Ohio Trac. & Lt.—6%	73	64	75
North. States Pwr.—7%	99	95	100
Ohio Gas & Elec.—7%	90	87	100
Ohio Pwr.—6%	90	85	95
Ohio Pub. Serv.—7%	97	97	100
Pac. Gas & Elec.—6%	96	92	99
Pac. Pwr. & Lt.—7%	f101½	101	102½
ePenn Central Lt. & Pwr.—no par	69½	63	69½
Penn-Ohio Pwr. & Lt.—7%	96	91	100
Penn-Ohio Pwr. & Lt.—8%	104	101	110
Penn. Pub. Serv.—7%	90	90	100
Penn Pub. Serv.—6%	80	80	90
Penn. Pwr. & Lt.—$7—no par	f103½	103	104
ePhila. Elec.—8%—25	42½	37¼	45
Portland Elec. Pwr.—7%	97	95	99
Portland Elec. Pwr.—6%	68	70	80
Pwr. Corp. of N. Y.—7%	99	96	102
Pub. Serv. of No. Ill.—6%	108	90	97
Pub. Serv. of Okla.—7%	94	87	95
Pub. Serv. Elec. & Gas—6%	f 96¼	92½	96¼
Puget Sound Pwr. & Lt.—7%	102	102½	107
Rochester Gas & Elec.—5%	105	80	98
So. Calif. Edison—8%	127	115	128
So. Calif. Edison—7%	*109	105	107½
So. Calif. Edison—6%	96	90	95½
Tenn. Elec. Pwr.—6%	85	80	85
Tenn. Elec. Pwr.—7%	98½	93	103
Tenn. Elec. Pwr.—$6—no par	80	72	84
Tex. Pwr. & Lt.—7%	f102½	102	104
Toledo Edison—8%	110	109	114
Toledo Edison—7%	100	94	101½
Utah Pwr. & Lt.—7%	f100½	100	101½
Utica Gas & Elec.—7%	101	100	104
Vermont Hydro-Elec.—7%	90	87	96
Virginia Pwr.—7%	102	94	107
West Penn—7%	f 98½	94	100
West. States Gas & Elec.—7%	89	82	92
Wis.-Minn. Lt. & Pwr.—7%	90	92	95
Yadkin River Pwr.—7%	f102	102	103
Holding Companies			
Amer. & Foreign Pwr.—7%	f 90½	87	94
Amer. Elec. Pwr.	102	96	104½
Amer. Gas & Elec.—6%—no par	89	85	91
Amer. Lt. & Trac	100	93	101½
Amer. Pwr. & Lt.—6%	93	84	91½
Amer. Pub. Serv.—7%	98	88	94
Amer. Pub. Utilities—5%	78	71	82
Amer. Pub. Utilities—7%	90	87	95
Amer. Water Wks. & Elec.—6%	104	95½	110¼
Amer. Water Wks. & Elec.—7%	98	97¼	103
Assoc. Gas & El.—7%—1% extra—50	f 52	....	....
Assoc. Gas & Elec.—$6—no par	84	....	....
Carolina Pwr. & Lt.—$7—no par	104	100	107
Central Ark. Ry. & Lt.—7%	97	91	98½
Central Ind. Pwr.—7%	90	88	95
Central States Elec.—7%	93	87	98
Cities Serv.—6%	83½	80	84
Columbia Gas & Elec.—7%	107¾	104¼	110½
Commonwealth Pwr.—6%	82	80	85½
Continental Gas & Elec.—7% pfc. pf	93	85	97
Continental Gas & Elec.—7% pr. pf	92½	89	95
Elec. Bond & Share—6%	f104	104	105½
Elec. Investors—7%	93	90	100
Elec. Pwr. & Lt., ctfs.	f 92½	90	94
Elec. Pwr. & Lt., ctfs. 40% pd.	f108¾	100	110
Galveston-Houston Elec.—6%	68	70	75
Gen. Gas & Elec.—6%	220	72	240
Gen. Gas & Elec.—7%	150	120	....
Gen. Gas & Elec.—$7—no par	150	90	175
Gen. Gas & Elec.—$8—no par	165	104½	180
Georgia Lt., Pwr. & Rys.—6%	80	74	85
Jersey Central Pwr. & Lt.—7%	97	90	96
aMiddle West Utilities—7%	97½	91½	98¾
Middle West Utilities—pr. lien 7%	105	98	108
Natl. Lt., Ht. & Pwr.—5%	62	40	65
Natl. Pwr. & Lt.—$7—no par	99	95	99
No. Amer.—6%—50	f 49¾	46½	50½
No. Tex. Elec.—6%	55	50	75
Penn-Ohio Elec.—7%	94	88½	96
Phila. Co.—50	49	45½	49
Pub. Serv. Corp. of N. J.—7%	f103	99	104
Pub. Serv. Corp. of N. J.—8%	114	108¾	115½
Southeastern Pwr. & Lt.—7%	97	90	100
Southern Cities Utilities—7%	84	77	100
Southwestern Pwr. & Lt.—7%	99	90	102
Standard Gas & Elec.—8%	f 54½	50½	54¾
Standard Gas & Elec.—7%	98½	96	100
Standard Pwr. & Lt.—7%	110	95	114½
United Gas & Elec.—5%	91	80	94
cUnited Gas Improv.—50	99	79½	100
United Lt. & Pwr.—$4—no par	50	41	51
United Lt. & Pwr.—$6.50—no par	93	83	99
Western Pwr. Cor.—7%	92	84	95½
COMMON STOCKS			
Operating Companies			
Adirondack Pwr. & Lt.—50	89	31	98
Appalachian Pwr.—no par	79	70	83
Arizona Pwr.	29	15	33
Arkansas Lt. & Pwr.	100	65	101
Brooklyn Edison	f138	120¾	140¾
Buffalo Gen. Elec.	71	44	73¾
Cleveland Elec. Illg.	240	200	250
aCommonwealth Edison	136½	130½	141¾
eConsol. Gas, Elec. Lt. & Pwr.	45	32	45
Dayton Pwr. & Lt.	410	180	460
Detroit Edison	129	110	134½
Eastern Tex. Elec.	68	70	75½
dEdison Elec. Illum. of Boston	204½	200	213
Georgia Ry. & Pwr.	101	62	102
aKy. Hydro.-Elec.	g 92	85½	92½
Long Is. Light	105	60	105
Miss. River Pwr.	64	37	68
Montana Pwr.	f 95½	64	99½
New Orleans Pub. Serv.—no par	33	31	38½
Niagara Falls Pwr.—no par	60	45½	77
Niagara, Lock. & Ont. Pwr.—no par	65	60	73
North. Ohio Pwr.	12	5	13½
North. States Pwr.	121	103	125
North. Tex. Elec.	40	40	70
Pacific Gas & Elec.	f116	102½	118½
ePenn. Wtr. & Pwr.	175	126½	175
ePhila. Elec.—25	42½	37¼	47⅜
Portland Elec. Pwr.	36	40	53
Pwr. Corp. of N. Y.—no par	81	15	89¾
Pub. Serv. Co. of No. Ill.	118	97	124
Puget Sound Pwr. & Lt.	53	49	61
So. Calif. Edison	125	102	139
Tenn. Elec. Pwr.—no par	60	47	69
Toledo Edison	25	21	25
Utica Gas & Elec.	200	100	200
Virginia Pwr.	66	65	92
Virginia Ry. & Pwr.	g123½	64½	123½
West Penn	g116	105	145
Holding Companies			
Amer. & Foreign Pwr.—no par	f 43½	27½	47
Amer. Gas & Elec.—no par	80	70	85
Amer. Lt. & Trac.	190	139	193½
Amer. Pwr. & Lt.	60	52	67
Amer. Pub. Serv.	85	45	90
Amer. Public Utilities	95	70	103
Amer. Wtr. Wks. & Elec.	f 64	34⅜	68½
Assoc. Gas & Elec., Class A	f 45½	....	....
Carolina Pwr. & Lt.—no par	400	290	430
Central States Elec.	115	70	102
Cities Service (new)	39	34	43
Columbia Gas & Elec.—no par	f 72½	45½	74½
Commonwealth Pwr. Corp—no par	150	106	173
Cons. Gas—no par	f 88½	74½	92⅜
Continental Gas & Elec.	130	77	99
Elec. Bond & Share Sec.	f 67	67½	70½
Elec. Investors	62	30	66
Elec. Pwr. & Lt., ctfs.	f 36½	17⅜	40⅛
Federal Lt. & Trac.	f 30¼	29	36
Galveston-Houston Elec.—no par	20	32	40
General Gas & Elec.	220	72	240
Georgia Lt., Pwr. & Rys.	68	25	74
Georgia Ry. & Pwr.	101	62	102
Jersey Central Pwr. & Lt.	45	15	50
Lehigh Pwr. Securities—no par	145	82	131
aMiddle West Utilities—no par	117	82½	125
aNational Elec. Pwr.	94	94¾	94
Natl. Lt., Ht. & Pwr.	11	11	....
Natl. Pwr. & Lt.—no par	338	185	357
No. Amer.—10	f 58⅜	41½	60½
Phila. Co.—50	f 59	51½	62½
Pwr. Securities—no par	10	....	....
Pub. Serv. Corp. of N. J.—no par	f 84½	62⅜	87½
Republic Ry. & Lt.	64	49	65
Southeastern Pwr. & Lt.	146	45	158
Southern Cities Utilities	65	30	71
Standard Gas & Elec.—no par.	f 58½	40½	59½
United Gas & Elec. (Conn.)—no par	47	26	49
United Lt. & Pwr.—A—no par	133	42	138
United Lt. & Pwr.—B—no par	140	49	100
Western Pwr. Corp.—no par	60	34	68
BONDS			
Operating Companies			
Adir. Pwr. & Lt.	6s 1950	104	102½ 105½
Alb. Pwr.	5s 1946	98½	96 100
Appalachian Pwr.	5s 1941	96½	96 99¼
Brooklyn Edison	5s 1949	100¾	99½ 103
	6s 1930	103¼	103¼ 105½
Cleveland Elec. Illum.	5s 1939	101	100 102
Com'wealth Edison	5s 1943	101	99½ 102¼
	5s 1953	99	98½ 101
eConsol. Gas Elec. Lt. & Pwr.	4½s 1935	97¼	93½ 97¾
	6s 1949	107½	104¾ 107¾
Consumers' Pwr.	5s 1936	98	99 100¼
	5s 1952	95	90¾ 100
Detroit Edison	5s 1933	101½	99¾ 102½
Duquesne Lt.	6s 1949	106¾	104¾ 107¾
Great Western Pwr.	5s 1946	97¾	95 99¼
Kansas City Pwr. & Lt.	5s 1952	97⅞	95⅜ 101
Miss. River Pwr.	5s 1951	98	96½ 100¾
Montana Pwr.	5s 1943	99½	97⅜ 100⅜
New Eng. Pwr.	5s 1951	101	100¾ 103
N. Y. Edison	6½s 1941	113⅜	112 115½
Niagara Falls Pwr.	6s 1932	105⅜	103¾ 106½
No. States Pwr.	5s 1941	95⅜	93 99½
No. States Pwr.	6s 1941	105½	103 107½
Ohio Pwr.	7s 1951	106	106¼ 107½
Pacific Gas & Elec.	5s 1942	94⅜	93½ 99
ePenn. Wtr. & Pwr.	5s 1940	100½	100 100½
cPhil. Elec.	5s 1966	102½	100½ 103½
	5½s 1947	106	103½ 107
	6s 1941	106½	106 108⅜
Portland Elec. Pwr.	6s 1947	99⅜	96½ 100
So. Cal. Edison	5s 1939	98	99¼ 101
	6s 1944	103	102½ 105½
Tenn. Elec. Pwr.	6s 1947	102½	99½ 104½
Tex. Pwr. & Lt.	5s 1937	98	97 99½
Toledo Edison	7s 1941	108	108⅜ 110
Utah Pwr. & Lt.	5s 1944	95	91 98½
Holding Companies			
Ala. Trac. Lt. & Pwr.	5s 1962	97	86 97½
Amer. Gas & Elec.	6s 2014	97	96½ 98½
Amer. Pwr. & Lt.	6s 2016	95½	94 98
Am. Wtr. Wks. & Elec	5s 1934	95⅜	92½ 98
Assoc. Gas & Elec.	6½s 1954	f103	....
Central Ind. Pwr.	6s 1947	97	95½ 99½
Commonwealth Pwr.	6s 1947	101⅜	97⅜ 103⅜
Consol. Cities Lt., Pwr. & Tr.	5s 1962	79	75½ 82½
Ill. Pwr. & Lt.	6s 1953	100	100½ 102½
United Lt. & Rys.	5s 1932	94½	93⅜ 97½
	6s 1952	98	95⅜ 100¼
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Mfg.		105½	103¼ 108
bWagner Elec.		79⅜	79 91
West. Elec. Instrument—A		f 25⅜	19⅜ 26⅞
Western Elec.—7%		115	113¾ 117
Worthington Pump & Mach.—A		79	79 88
Worthington Pump & Mach.—B		64⅜	64⅜ 76¾
COMMON STOCKS			
Allis-Chalmers Mfg.		f 82	71½ 86½
Amer. Bosch Magneto—no par		f 31½	26⅜ 54½
Elec. Storage Battery—no par		f 64½	60¼ 70¼
General Elec.		f 316½	227½ 320
General Elec.—10		f 11⅜	11 11⅜
aHurley Machine—no par		48	41½ 56
Timken Roller Bearing		f 43½	37½ 46½
bWagner Elec.		35	26½ 50
Westghse. Elec. & Mfg.—50		f 76½	66½ 84
West. Elec. Instrument		f 17½	9½ 18
Worthington Pump & Mfg.		f 39½	36¼ 79¾
BONDS			
General Elec.	3½s 1942	86½	83 87
	5s 1952	107½	101½ 107½
Robbins & Myers	7s 1952	61⅜	62½ 73½
Wagner Elec. Mfg.	7s	g100½	100½ 102
Western Elec.	5s 1944	99¾	98 101
Westghse. Elec. & Mfg.	7s 1931	106	103½ 108½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore. fBid price, low and high, Tuesday, Aug. 11. gLatest quotations available.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Electrical Decade

THE history of man's civilization has been one of gradual changes, always an advance upon his former condition and mode of living. These spans of time have been divided into ages, each indicating a degree of civilization. Thus, history records the older and newer Stone Ages, the Bronze Age, the Iron Age, the Steam Age, and now man is just entering into the Electrical Age, which scientists prognosticate will be succeeded by the Chemical Age. Each age has brought something better to mankind, better domestic and industrial conditions, which have resulted in a higher type of morals, a better mode of living, less selfishness and more love for one's fellow-man.

The decade succeeding the great world conflict finds mankind, especially the inhabitants of this country, living in a new age, the Age of Electricity, the greatest age through which man has passed up to the present time. True, electrical energy had been playing a prominent part in this nation some thirty years before the war, but not until every reserve force was called into play to win the conflict did man realize the advantages of electrical energy as a source of industrial power, and almost simultaneously as a labor-saver in the home. So that the present decade may well be termed the "Electrical Decade."

The demands of the American people for more and more electrical energy in the home and factory, on the farm and for transportation purposes during the present decade is clearly pictured in the increased capital required by the central station companies of the country to take care of the necessary expansion. In 1920 the aggregate capitalization of the central station companies of the country was $4,100,000,000. This figure has increased to approximately $7,000,000,000 at the present time, and it is estimated will total $9,860,000,000 at the opening of 1930. This intensive call for central-station service will have resulted in the industry more than doubling its capital invested in generation, transmission and distribution equipment during the ten-year period 1920-1930.

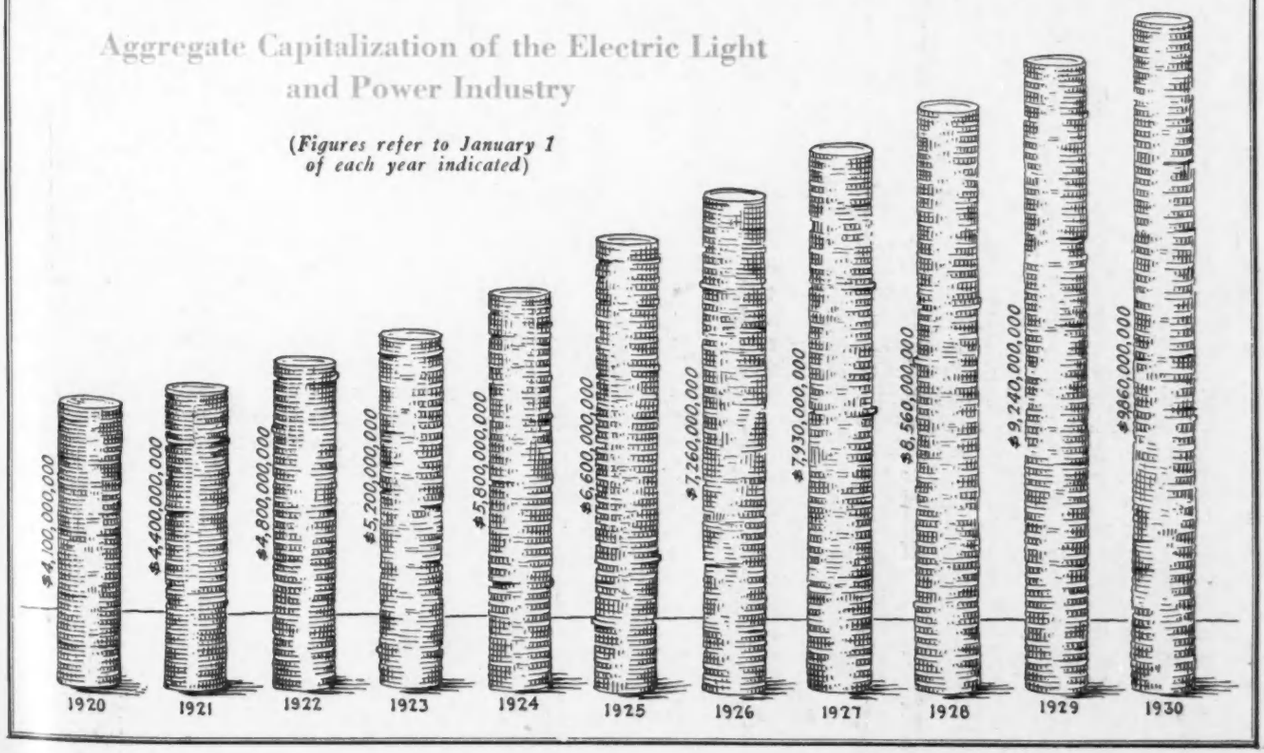
This new capital has and will come from the people themselves. A very large part representing investments made by customers in the stock of their local utilities. The end of the decade should find a total of 17,000,000 shares of electric light and power stock in the hands of customers and employees.

Thus the present decade becomes not only the electrical decade, but the decade of understanding between the public and industry through the study of each other's problems.

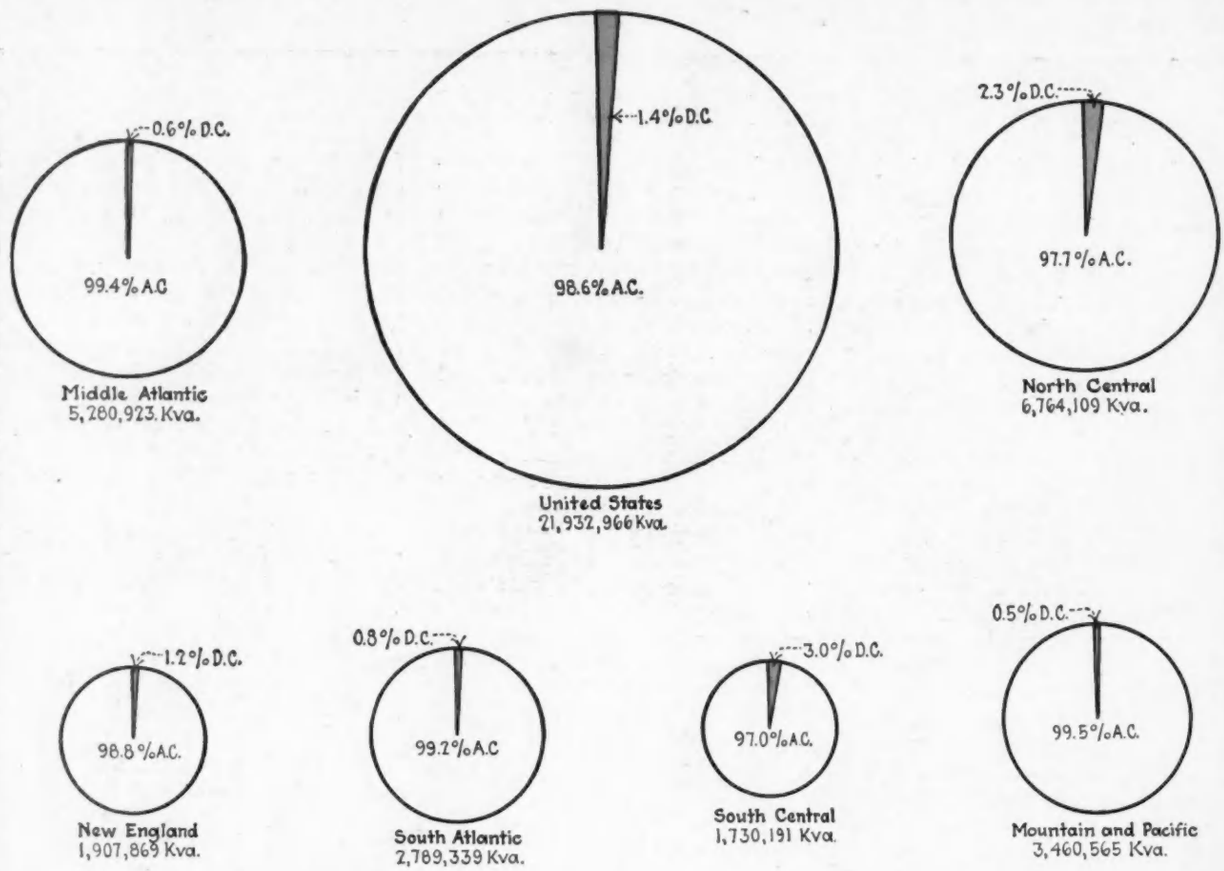
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Aggregate Capitalization of the Electric Light and Power Industry

(Figures refer to January 1 of each year indicated)



Relation Between the Total Rating of A.C. and D.C. Generators Installed in Central Generating Plants of the Country



Survival of the Fittest

EVERY new theory, every new invention and every new product must stand the test of time. No matter how fully it may have met the needs of the age in which it was first presented, it must also advance with the changing conditions and must always be ready to meet any challenge which may come through the advances in the sciences and industry or in the mode of living. Many theories and inventions which have fully met the scientific thought or economic needs of the day have been relegated to the past as civilization advanced to higher planes of activity.

A concrete instance of this is presented in the history of the utilization of direct current in the light and power industry. As the steam engine is being supplanted by the more efficient turbine, so is the direct-current generator being replaced by the alternating-current generator. In fact, this elimination of the direct-current generator is even more positive than is the elimination of the steam engine. Back in 1902, when the first census of the electric light and power industry was taken, the rating of the direct-current generators represented 39.3 per cent of the total generator installation of the country. By 1907 this figure had decreased to 18 per cent, in 1912 to 9.2 per cent, in 1917 to 4.9 per cent, and at the present time it is doubtful if more than 1 per cent of the total generator rating of the country is direct current. This rapid elimination of the direct-current generator by the alternating-current generator has been due very largely to the advantages which alternating current has over direct current in connection with high-voltage, long-distance transmission, transformation from one voltage to another and the operation of induction motors. The last strongholds of the direct-current generator are in the metropolitan city congested districts, the electrochemical plants and in the small factory, and these are rapidly being surrendered.

The change from direct-current to alternating-current generation is just another reflection of the constant efforts of the electric light and power industry to give the best service possible, not only to the metropolitan districts, but also to the rural districts, which must remain largely without electric service except through long-distance transmission. Apparently the inventive genius of the engineer has disposed of the direct-current generator and use of direct current except where unidirectional current is essential.